

ENVIRONMENTAL ASSESSMENT BOARD



ONTARIO HYDRO DEMAND/SUPPLY PLAN HEARINGS

VOLUME: 134

DATE: Wednesday, April 15, 1992

BEFORE:

HON. MR. JUSTICE E. SAUNDERS	Chairman
DR. G. CONNELL	Member
MS. G. PATTERSON	Member

EARR
ASSOCIATES &
REPORTING INC.

(416) 482-3277

2300 Yonge St. Suite 709 Toronto, Canada M4P 1E4

ENVIRONMENTAL ASSESSMENT BOARD
ONTARIO HYDRO DEMAND/SUPPLY PLAN HEARING

IN THE MATTER OF the Environmental Assessment Act,
R.S.O. 1980, c. 140, as amended, and Regulations
thereunder;

AND IN THE MATTER OF an undertaking by Ontario Hydro
consisting of a program in respect of activities
associated with meeting future electricity
requirements in Ontario.

Held on the 5th Floor, 2200
Yonge Street, Toronto, Ontario,
Wednesday, the 15th day of April,
1992, commencing at 10:00 a.m.

VOLUME 134

B E F O R E :

THE HON. MR. JUSTICE E. SAUNDERS	Chairman
DR. G. CONNELL	Member
MS. G. PATTERSON	Member

S T A F F :

MR. M. HARPUR	Board Counsel
MR. R. NUNN	Counsel/Manager, Information Systems
MS. C. MARTIN	Administrative Coordinator
MS. G. MORRISON	Executive Coordinator

A P P E A R A N C E S

B. CAMPBELL	)	ONTARIO HYDRO
L. FORMUSA)	
B. HARVIE)	
J.F. HOWARD, Q.C.)	
J. LANE)	
G. A. KARISH)	
J.C. SHEPHERD	)	IPPSO
I. MONDROW)	
J. PASSMORE)	
R. WATSON	)	MUNICIPAL ELECTRIC
A. MARK	)	ASSOCIATION
S. COUBAN	)	PROVINCIAL GOVERNMENT
P. MORAN	)	AGENCIES
J. MacDONALD)	
C. MARLATT	)	NORTH SHORE TRIBAL COUNCIL,
D. ESTRIN	)	UNITED CHIEFS AND COUNCILS
H. DAHME	)	OF MANITOULIN, UNION OF
		ONTARIO INDIANS
D. POCH	)	COALITION OF ENVIRONMENTAL
D. STARKMAN	)	GROUPS
D. ARGUE)	
T. ROCKINGHAM		MINISTRY OF ENERGY
B. KELSEY	)	NORTHWATCH
L. GREENSPOON)	
P. McKAY)	
J.M. RODGER		AMPCO
M. MATTSON	)	ENERGY PROBE
T. McCLENAGHAN)	
A. WAFFLE		ENVIRONMENT CANADA
M. CAMPBELL	)	ONTARIO PUBLIC HEALTH
M. IZZARD	)	ASSOCIATION, INTERNATIONAL
		INSTITUTE OF CONCERN FOR
		PUBLIC HEALTH
G. GRENVILLE-WOOD		SESCI

A P P E A R A N C E S
(Cont'd)

D. ROGERS		ONGA
H. POCH	)	CITY OF TORONTO
J. PARKINSON)	
R. POWER		CITY OF TORONTO, SOUTH BRUCE ECONOMIC CORP.
S. THOMPSON		ONTARIO FEDERATION OF AGRICULTURE
B. BODNER		CONSUMERS GAS
J. MONGER	)	CAC (ONTARIO)
K. ROSENBERG)	
C. GATES)	
W. TRIVETT		RON HUNTER
M. KLIPPENSTEIN		POLLUTION PROBE
N. KLEER	)	NAN/TREATY #3/TEME-AUGAMA
J. OLTHUIS	)	ANISHNABAI AND MOOSE RIVER/
J. CASTRILLI	)	JAMES BAY COALITION
T. HILL		TOWN OF NEWCASTLE
M. OMATSU	)	OMAA
B. ALLISON)	
C. REID)	
E. LOCKERBY		AECL
C. SPOEL	)	CANADIAN VOICE OF WOMEN
U. FRANKLIN	)	FOR PEACE
B. CARR)	
F. MACKESY		ON HER OWN BEHALF
D. HUNTER	)	DOFASCO
M. BADER)	
B. TAYLOR	)	MOOSONEE DEVELOPMENT AREA
D. HORNER	)	BOARD AND CHAMBER OF
H. WATSON	)	COMMERCE

A P P E A R A N C E S

(Cont'd)

T. HEINTZMAN	)	ATOMIC ENERGY OF CANADA
D. HAMER)	
C. FINDLAY)	
P.A. NYKANEN	)	CANADIAN MANUFACTURERS ASSOCIATION - ONTARIO
G. MITCHELL		SOCIETY OF AECL PROFESSIONAL EMPLOYEES
S. GOUDGE		CUPE
D. COLBORNE		NIPIGON ABORIGINAL PEOPLES' ALLIANCE
R. CUYLER		ON HIS OWN BEHALF
L. BULLOCK	)	CANADIAN NUCLEAR ASSOCIATION
L. CHAN)	

Digitized by the Internet Archive
in 2022 with funding from
University of Toronto

<https://archive.org/details/31761114685563>

I N D E X o f P R O C E E D I N G S

Page No.

<u>DAVID WHILLANS,</u> <u>KURT JOHANSEN,</u> <u>FRANK CALVIN KING,</u> <u>WILLIAM JOHN PENN,</u> <u>IAN NICHOL DALY; Resumed.</u>	23475
Cross-Examination by Ms. McClenaghan	23475

L I S T o f E X H I B I T S

No.	Description	Page No.
615	Elkraft's 1000 Kilowatts Stall Regulated Wind Turbine.	23474
616	Vindeby, The First Off-shore Wind Farm in the Danish Wind Power Program.	23474
520.104	Interrogatory No. 9.2.123.	23488
520.107	Interrogatory No. 9.7.535.	23514
520.103	Interrogatory No. 9.2.102.	23521
520.102	Interrogatory No. 9.2.44.	23531
617	Package entitled: Materials Relating to Early Shutdown of Nuclear Stations.	23540
618	Document: Cost of Nuclear Power, Fourth Report, June 7, 1990.	23574
619	Materials on Nuclear Economic Viability.	23574
520.108	Interrogatory No. 9.6.46.	23625

TIME NOTATIONSPage No.

	10:04 a.m.	-----	23474
	10:14 a.m.	-----	23480
	10:25 a.m.	-----	23486
	10:43 a.m.	-----	23496
	10:55 a.m.	-----	23505
	11:18 a.m.	-----	23516
Recess	11:32 a.m.	-----	23523
Resume	11:50 a.m.	-----	23523
	12:11 p.m.	-----	23533
	12:30 p.m.	-----	23544
	12:50 p.m.	-----	23557
Luncheon recess	12:24 p.m.	-----	23559
Resume	2:37 p.m.	-----	23559
	2:50 p.m.	-----	23569
	3:12 p.m.	-----	23581
	3:30 p.m.	-----	23591
Recess	3:40 p.m.	-----	23596
Resume	4:00 p.m.	-----	23596
	4:12 p.m.	-----	23604
	4:30 p.m.	-----	23615
	4:48 p.m.	-----	23624
Adjourned	4:59 p.m.	-----	23631

1 ---Upon commencing at the 10:04 a.m.

2 THE REGISTRAR: Please come to order.
3 This hearing is now in session. Please be seated.

4 THE CHAIRMAN: Overnight we have had two
5 new exhibits filed which should go onto the record.
6 They are both filed by Dynamo Genesis Incorporated.
7 The first is Exhibit 615 which is entitled Elkraft's
8 1000 Kilowatts Stall Regulated Wind Turbine, and second
9 exhibit, 616, Vindeby, The First Off-shore Wind Farm in
10 the Danish Wind Power Program.

11 ---EXHIBIT NO. 615: Elkraft's 1000 Kilowatts Stall
12 Regulated Wind Turbine.

13 ---EXHIBIT NO. 616: Vindeby, The First Off-shore Wind
14 Farm in the Danish Wind Power Program.

15 THE CHAIRMAN: Ms. McClenaghan?

16 MS. MCCLENAGHAN: Thank you, Mr.
17 Chairman.

18 Just to indicate where we are headed
19 today, we are going to be completing our questions in
20 Exhibit 12, the materials on nuclear performance this
21 morning, or 612, sorry. And as well we will be turning
22 to the materials on early shutdown of nuclear reactors,
23 which will be a subsequent exhibit.

24 This afternoon we will be dealing with
25 the international performance that we put over from
yesterday and then we will be turning to materials on

1 economic viability of nuclear generating stations.

2 THE CHAIRMAN: And do you do you think
3 you will be finished today?

4 MS. McCLENAGHAN: My estimate remains
5 that by noon tomorrow we will be finished.

6 THE CHAIRMAN: Thank you.

7 MS. McCLENAGHAN:

8 DAVID WHILLANS,
9 KURT JOHANSEN,
10 FRANK CALVIN KING,
WILLIAM JOHN PENN,
IAN NICHOL DALY; Resumed.

11 CROSS-EXAMINATION BY MS. McCLENAGHAN:

12 Q. I would like to begin by referring to
13 the evidence, Mr. Penn, that we were dealing with at
14 the end of yesterday which concerned the pressure tube
15 failure and the clearance between the calandria and the
16 pressure tubes. And I think you had stated that there
17 were six units where that's known to be a problem; is
18 that right?

19 MR. PENN: A. I am not quite sure what
20 you are referring to. I remember talking about SLAR
21 and recognizing that there was Pickering 5 and 6 as
22 well as Bruce 1, 2, 3, 4, I think.

23 Q. Right. And I just want to refer you
24 to your testimony in Volume 122, at page 21435 through
25 to 21437, where I believe you are discussing the same

1 issue with Dr. Connell. And you began on page 21435 by
2 referring to pressure tube failures, and then at the
3 beginning of 21436 about the hydride penetration and
4 elongation problem, and then you continued on page
5 21437 by talking towards line 16 of that page, that if
6 you have enough garter springs in the channel and they
7 are in the right place, and the pressure tube can't
8 touch the calandria tube you don't form the temperature
9 gradient to cause the process to start. And Dr.
10 Connell asked if that was a problem of the past then,
11 and you went on to say you believe so. You have now
12 what you call tight garter springs that the clasp the
13 pressure tube and don't move, and we believe that's the
14 solution.

15 I just want to clarify that in terms of
16 your evidence yesterday, it wouldn't be fair to
17 characterize it as a problem of the past because
18 this problem has not been solved at six of the units,
19 as you just mentioned, where the SLAR program has been
20 decommitted and you are considering what to do next?

21 A. Well, we believe we have a full
22 understanding of the problem, so that's a long way to
23 going to a solution.

24 Secondly, as I gave evidence, and I think
25 Mr. Daly also spoke a little bit about it, we have a

1 very significant in-service inspection program on the
2 units that we know have pressure tubes in contact with
3 the calandria tubes. And indeed this in-service
4 inspection program is the result of discussions with
5 the Atomic Energy Control Board and an agreement on
6 what is necessary to be done.

7 So I think that while we would not claim
8 that the problem of pressure tube degradation is
9 totally solved, we will certainly claim we have a clear
10 understanding of the mechanisms involved.

11 Q. But the situation is that it is still
12 a concern at Pickering 4, 5 and 6, and Bruce, 1, 2, 3
13 and 4?

14 A. Well, Pickering 4, as you know, is in
15 the process of being retubed. At this point in time
16 all the pressure tubes have been removed from Pickering
17 4. It's some five weeks ahead of schedule, and we are
18 preparing to replace the pressure tubes with new ones.
19 So that's Pickering 4.

20 Bruce 1, most likely, although it could
21 be Bruce 2, depending on steam generator situation,
22 will be the next reactor to be retubed and that will
23 start in 1994, and we have already put in
24 infrastructure at the Bruce nuclear power development
25 site to get on with that job.

1 Bruce 2, if not done first, will follow
2 in 1997. We project 30 months for retubing the first
3 unit at Bruce, and I believe 27 months for the second
4 one. The third and fourth we believe the life is of
5 the order of 25 years, and I gave in my direct evidence
6 exactly when at the present time we plan to retube
7 those two units and that's in the next century around
8 about 2003 and 2005.

9 Q. Well, is it more fair to say then
10 that once the retubing is done in all of those units
11 that then you hope the problem will be a thing of the
12 past?

13 A. Certainly the possibility of any
14 further delayed hydride cracking of pressure tubes will
15 be diminishingly small at that time.

16 There is always the question of
17 accommodation of longitudinal growth of pressure tubes,
18 which in our "B" reactors in Darlington is estimated to
19 occur around 30 years. And apart from that there is
20 also continuing research into fracture toughness of
21 zircaloy alloys, and that is another reason why we will
22 retube those reactors at about somewhere between 25 and
23 30 years life.

24 Q. Mr. Penn, I would like to look at the
25 issue of damage caused by repairs. And I understand

1 that after water lancing operations at Bruce 1 and 2 to
2 remove hard deposit build up, that a large number of
3 boiler tube leaks occurred, is that your understanding?

4 A. Well, you are now talking steam
5 generators. We have moved from pressure tubes?

6 Q. Yes, we have.

7 A. To remove the hard crud deposits in
8 boilers, I think in Bruce Unit 2, 1 and 2, we used a
9 high pressure water lancing process which allowed us to
10 increase the output of those units again that had
11 previously been affected by oscillations in the steam
12 generators and reduced rating down to about 70 per
13 cent. They went back up to their maximum continuous
14 rating. And I have no knowledge, and maybe Mr. Daly
15 could help here, I don't know, I have no knowledge that
16 following water lancing that there was, as you put it,
17 a very large number of tube leaks in the heat
18 exchangers, there may very well have been a few but I
19 am not aware of the process itself causing it.

20 MR. DALY: A. There certainly were a
21 number of leaks on both units. Your original question,
22 whether those leaks were as a result of the repairs is
23 somewhat questionable at this stage. Certainly it was
24 one question we asked ourselves, whether after having
25 done the water lancing and then had some tube leaks,

1 whether that was a contributing factor. And it is
2 possible in some cases that by knocking the deposits
3 off the tubes you had uncovered some small holes. That
4 is one possibility. However, at the present time we
5 can't sort of conclusively say that that's the case.
6 [10:14 a.m.]

7 There is a current inspection and
8 maintenance program going on in the Bruce steam
9 generators. Whether that will determine that any
10 changes are needed to the water lancing remains to be
11 seen, but water lancing is a fairly common technique.

12 Q. My question is, is it fair to say
13 that there were an increased number of leaks after
14 the water lancing was done?

15 A. It's fair to say that. Whether that
16 was a direct cause of the water lancing, or whether it
17 was just due to continuing degradation, or some
18 combination of the two is not totally clear at this
19 stage, and that's why we continue to inspect the steam
20 generators.

21 Q. All right. Turning to the next
22 issue. I understand that one of the boilers in Bruce 2
23 was damaged by a lead blanket being left in the boiler
24 after a repair in 1986; is that right?

25 MR. PENN: A. I wouldn't say that it was

1 caused by the lead blanket. The lead blanket which I
2 referred to in yesterday's testimony is a shielding
3 blanket to allow our maintenance technicians to enter
4 the steam generator from the top, and if there's any
5 activity in the steam generator, to protect them. A
6 lead blanket was left in a steam generator in Bruce
7 Unit 2 without knowledge of the station staff, and we
8 have had intergranular and transgranular stress
9 corrosion cracking of -- well, appears to have in some
10 of these tubes. And we feel that - and it's a theory
11 at this time - that the lead that obviously melted
12 under the temperatures dripped into the tube banks and
13 may have acted in some catalytic manner to aggravate
14 the problem in the top bank of the tubes.

15 Q. Is it that boiler which Hydro is now
16 considering replacing?

17 A. We haven't reached a decision on
18 that. We are inspecting it as Mr. Daly said. We know
19 the area, right at the top of the tube bank, at the
20 very top of the steam generators where the lead blanket
21 was is the area of concern.

22 We are doing thermal hydraulic
23 calculations to see whether, given the very large
24 redundancy in steam generators to produce the necessary
25 steam pressures and temperatures and flow rates,

1 whether one solution will be just to cut that section
2 out and plug it or, or whether the full state of the
3 steam generator deserves to be replaced. And in my
4 direct evidence we took the pessimistic situation that
5 we would not only replace that one in the financial
6 test but, possibly, all eight of them in that
7 particular unit.

8 Q. I understand that the fueling
9 machine-related equipment is used extensively during
10 retubing; is that correct?

11 A. Are you going back to pressure tubes
12 now? It's certainly not used in any sense whatsoever
13 with the steam generators.

14 Q. No, no. It's another issue. I'm
15 sorry.

16 A. The only time we use the fueling
17 machines is to defuel the reactors in the preparation
18 for pressure tube removal. We also with a SLAR tool
19 use a special fueling machine head to implement that.

20 Q. But I understand it uses the same
21 fueling machine bridge; is that right?

22 A. Well, the fueling machine is
23 associated and directly suspended from the bridge.

24 Q. Do you agree that the fueling machine
25 performance since retubing at Pickering 1 and 2 has

1 been worse than it was prior to the retubing?

2 MR. DALY: A. In 1990 it was. We had a
3 poor year on fueling handling in 1990 - I think we
4 discussed this a little earlier - and there were a
5 number of deratings attributable to fuel handling in
6 1990. And a contributing factor to that was the lack
7 of OM&A funds in previous years for maintenance in
8 general of which fuel handling was just one specific
9 example.

10 Following our experience in 1990
11 increased funding
12 and maintenance effort was put into fuel handling and
13 there was quite a dramatic turnaround in 1991, and the
14 situation improved very significantly at Pickering in
15 '91.

16 Q. All right. I would like to turn now
17 to the issue of forecasting. And I wonder if you can
18 advise when was the last time that Hydro's forecast for
19 each "A" station electricity production was too
20 pessimistic? That is, when was the last time Hydro
21 underforecast relative to actual production from the
22 "A" stations?

23 A. Well, I think, perhaps we could refer
24 to Interrogatory 9.2.12--

25 Q. Right.

1 A. --which is in your package.

2 Q. Yes, page 37 and 38.

3 A. Page 37.

4 THE CHAIRMAN: Which volume, please?

5 THE REGISTRAR: 9.2.12 would be .100.

6 MS. PATTERSON: Tab D.

7 MR. DALY: Volume 612?

8 THE REGISTRAR: That's already in.

9 MS. McCLENAGHAN: Yes, tab D of Exhibit

10 612.

11 THE CHAIRMAN: I'm sorry, what was the
12 page there again? I'm sorry.

13 MS. McCLENAGHAN: 37 and 38.

14 MR. DALY: Now this particular table on
15 page 37 does not give all of our forecasts. It gives
16 the first forecast of the year, and typically we would
17 make four or five forecasts.

18 However, I think that the general picture
19 here -- you get a general picture from this particular
20 interrogatory, this particular page of the trend in
21 both "A" station and "B" station forecasting. And as
22 you can see, if we look down to table 2 for Pickering
23 "A", the table shows the differences between the
24 forecast performance and the actual performance and it
25 certainly has been some years since we forecast

1 Pickering "A" accurately. A major factor there has
2 been, first of all, the pressure tube failure in '83
3 threw out a lot of the forecasts and then the time
4 taken to carry out that repair turned out to be longer
5 than we had anticipated.

6 Our most recent forecast, the forecast
7 done in '91 of the Pickering "A" forecast 58 per cent,
8 actual performance in '91 was 56 per cent. So I think
9 although a number of the forecasts have been or were
10 thrown off by retubing, we have gradually - as you can
11 see if you read vertically down the individual years,
12 we have been adjusting -- for example, if you go down
13 the '91 vertical column for Pickering "A", we were
14 originally forecasting 84 per cent but you can see, we
15 have been reducing the forecasts of Pickering "A" to
16 reflect our experience with retubing and bring those
17 units back in line.

18 MS. MCCLENAGHAN: Q. Would you say
19 though that the last time that you underforecast
20 relative to your actual production for Pickering "A"
21 was 1982?

22 MR. DALY: A. Well, the forecast shown
23 here, that's correct. As I say, we have made a number
24 of forecasts during the year. Whether some of those
25 were better or not, I don't recall offhand, but I think

1 essentially the picture portrayed here is accurate.

2 [10:25 a.m.]

3 Q. And for Bruce "A" the last time that
4 there was an underforecast was 1985; is that right?

5 A. Again, with that proviso that we are
6 just looking at one forecast here, actually, as you can
7 see, in Bruce "A" we had a period from '80 to '85,
8 where in fact we underforecast. The actual performance
9 was better than the forecast for a period of 6 years.
10 And then following the steam generator problems we
11 started to experience in '86, and also some of the
12 pressure tube work, which was sort of first of a kind
13 type outages, and that's been our main contributor to
14 our "A" station difficulties with forecasting, has been
15 these first of a kind outages.

16 However, our latest forecast in 1991 the
17 station actual production was 69 per cent as opposed to
18 the two previous forecasts of 64 and 56.

19 So I think the pattern on Bruce "A"
20 similar to Pickering "A" is that we have gone through a
21 period of overforecasting and we have been correcting
22 the "A" station forecasts to bring them into line. I
23 think our recent experience indicates that we have
24 brought the "A" station forecasts much better into line
25 recently.

1 Q. I take it that Hydro started changing
2 its forecast methodology in 1986 to increase the
3 derating adjusted forced outage rate or DAFOR allowance
4 for "A" stations; is that right?

5 A. Sorry, are you drawing that
6 conclusion from this page or from...

7 Q. No, just a question.

8 A. I think Hydro adjusts its DAFOR
9 allowance really on a continuing basis. These
10 forecasts are done typically four forecasts a year at
11 least and we do a wide variety of short-term and
12 mid-term and long-term forecasts. And DAFOR methods
13 and approaches to estimating DAFOR have evolved over
14 the years. I wouldn't put any sharp break point in
15 1986.

16 Obviously, around that period we had to
17 reflect the impact of the pressure tube failures and
18 the impact of that. I do recall around that time we
19 did start to build in a more specific major uncertainty
20 allowance, and that may be perhaps what you are
21 referring to, and we did do that. That was one of the
22 changes we made in our approach to estimating DAFOR
23 around that time.

24 Q. And I understand that you testified
25 in direct evidence that you expect in practice that

1 your actual performance will fall within the forecast
2 range within an 80 per cent probability?

3 A. That's our intention or goal. In
4 that sense we are trying to set ourselves up the same
5 way as the load forecasting process is set up with an
6 upper bound and a lower bound, 10 per cent probability
7 in the either direction. So that is our intent.

8 As you can see in some of these years we
9 didn't achieve that, in some of the earlier years we
10 were above our median forecast. So we have had kind of
11 a mixed experience.

12 Q. I would like to look at some other
13 particular forecasts. If you could turn to page 40 of
14 the materials. Page 40 is Interrogatory 9.2.123.

15 THE REGISTRAR: That is .104.

16 ---EXHIBIT NO. 520.104: Interrogatory No. 9.2.123.

17 MS. McCLENAGHAN: Q. We had asked
18 Ontario Hydro to provide information on the frequency
19 of extensions to planned outages, and it seems from the
20 answer that most planned outages were not completed on
21 time. Would you agree that Ontario Hydro's forecasts
22 for the duration of planned outages are usually too
23 optimistic?

24 MR. PENN: A. In the particular cases we
25 had provided in response to this interrogatory -- let

1 me qualify the answer a bit. Obviously the total
2 duration of the planned outages the forecast was
3 optimistic. However, in the forecasting process we do
4 make an allowance, based on our history of when the
5 planned outages are likely to come in. For example, if
6 history shows that the duration of a planned outage is
7 typically on average extended by 10 or 20 per cent, and
8 we do reflect that in the forecast by putting in an
9 addition to DAFOR to reflect this history. So although
10 the planned outage may come in longer than anticipated,
11 we do build some allowance for this into the
12 forecasting process.

13 Q. Now, in this time period, 1988 to
14 1991, you had forecast 36 outages and actually had 40
15 outages in that time period, but out of the 36 that you
16 had originally forecast to be completed, I understand
17 from this that 25 of them exceeded the forecast's
18 duration; is that right?

19 A. That's correct.

20 Q. And were those fully accounted for in
21 your DAFOR allowances?

22 A. I would have to go back and check the
23 specifics. My recollection is that the majority of
24 them were, but there were one or two, a small number of
25 major extensions, and this is typically what has thrown

1 the forecast off, is that we get into some long
2 extensions to some planned outages. Although the
3 majority of planned outages, would be - and their
4 extensions - reasonably well for case, long extensions,
5 for example, for steam generator work or additional
6 fuel channel inspection, have been some major
7 extensions which have put the forecast off.

8 Q. I would like to refer you to another
9 instance of specific forecasts at page 41 and 42 of the
10 materials. Both of these are documents from Ontario
11 Energy Board rate hearings, 1991 and 1992. And in the
12 first on page 41, Energy Probe asked Ontario Hydro to
13 provide in your best judgment the probability of actual
14 nuclear production falling 1 and 5 terawatthours short
15 of the one year ahead forecasts for 1991 and 1992. And
16 then Hydro gave various probabilities.

17 Do you see that?

18 A. I see that.

19 Q. And it says in the third paragraph
20 under the response, the best available judgment as to
21 the likelihood of achieving 5 terawatthours or greater
22 less than the forecast is that there is a 10 per cent
23 chance of this occurring; right?

24 A. Right.

25 Q. And then at page 44 of the materials.

1 Actually page 43 is the cover page, and that's an
2 excerpt from a submission by Ontario Hydro to the rate
3 hearing for 1993 rates, and this was filed just in
4 April 2nd, 1992; is that right?

5 A. Correct.

6 Q. And page 44 contains a page from that
7 submission, and under table 5.3 there is an indication
8 for, under nuclear, electricity production purchases
9 and sales, and under 1991 it indicates 68.7
10 terawatthours; right?

11 A. Correct. Perhaps I can just explain
12 that 68.7 should be contrasted with the -- I guess
13 that's the interrogatory on page 41, 5.8.4, where we at
14 the time of the OEB which would be around May/June of
15 that year 1990, our forecast at that the time was 80.7
16 terawatthours, and as you indicated we ended up with
17 68.7 terawatthours, a difference of some 11.9
18 terawatthours.

19 That difference was almost entirely due
20 to Darlington. In fact, 11.6 terawatthours of the 11.9
21 can be explained by the delays at Darlington.

22 Towards the bottom of that particular
23 interrogatory we did identify the main uncertainties
24 affecting the '91 forecast, and we did identify some
25 uncertainties at that time with the Darlington rotor.

1 This forecast was done before the fuel problem occurred
2 in December of 1990, so it was largely the fuel
3 problems that turned up in December of 1990 and the
4 subsequent delays that we have talked about that made
5 for the difference between the forecast and actual in
6 '91.

7 Q. So the main cause for the difference
8 wasn't the uncertainty that you reflected at item B,
9 but the fuel problem that you had in December; is that
10 right?

11 A. That is correct, yes.

12 THE CHAIRMAN: Hydro's submission to the
13 OEB perhaps should be given an exhibit number. I
14 realize it's only one page of it.

15 MS. McCLENAGHAN: Thank you. That's page
16 43 and 44.

17 THE CHAIRMAN: It should be given a
18 separate exhibit number

19 Yes, Mr. Campbell?

20 MR. B. CAMPBELL: Could we just check. I
21 believe it may have a number already. My recollection
22 is that it may have been filed by IPPSO, but I might be
23 wrong.

24 THE CHAIRMAN: That's quite a
25 possibility. I think that may be right. Let's give it

1 an exhibit number right, if it turns out it's not right
2 then we can adjust it.

3 MR. B. CAMPBELL: Sorry, Mr. Chairman, it
4 is 571.

5 THE CHAIRMAN: Thank you. Perhaps we
6 should just note that. It's part of 571.

7 Thank you, Mr. Campbell.

8 MR. DALY: I might also add in that
9 respect, I mentioned that we make three or four
10 forecasts year, so our subsequent forecasts following
11 the failures at Darlington were modified to take the
12 Darlington incident into account.

13 MS. McCLENAGHAN: Q. When you say you
14 make four or five forecasts year, that's for the year
15 that you are -- dealing with, taking into account the
16 contingencies that have occurred and the facts that
17 have occurred at that point in adjusting your earlier
18 forecast; is the fair?

19 MR. DALY: A. The forecast is actually
20 done for the current year plus the five following
21 years.

22 Q. All right. And the kind of question
23 that was asked on page 41 was a question that was
24 specifically recognizing that there was some
25 uncertainty and asking for probability of achieving 5

1 terawatthours less than the forecast, the best
2 available judgments that Ontario Hydro had at the time;
3 is that right?

4 A. That's right. And we did not foresee
5 the fuel problem that we got into at Darlington. It
6 was I think as Mr. Penn and I both testified to, it was
7 a surprise.

8 Q. Now, at page 42 of the material,
9 which is an interrogatory response from HR 20, page 42
10 of the material.

11 A. Right.

12 Q. And again the question was: Please
13 provide the best available judgment as to the
14 likelihood of nuclear production in 1992, achieving 1
15 terawatthour and 5 terawatthours less than the 81.5
16 terawatthours expected at that time by Ontario Hydro;
17 is that right?

18 A. Correct.

19 Q. And the answer from Ontario Hydro was
20 that the best available judgment as to the likelihood
21 of achieving 5 terawatthours or greater/less, than the
22 forecast of 79.9 terawatthours - there is already a
23 change - is that there is a 25 per cent change of this
24 occurring; is that right?

25 A. Right.

1 Q. And again, on page 44 is contained
2 Ontario Hydro's current best guess, I take it, for 1992
3 at 66 terawatthours; is that right?

4 A. That's right.

5 Q. So, the 1992 production that you are
6 currently forecasting is 15.5 terawatthours below what
7 was your one year ahead forecast; is that right?

8 A. Well, actually I made it 13.9, the
9 difference between the 66 and the 79.9.

10 Q. But that wasn't your original one
11 year ahead forecast, that had already been revised by
12 the time of this interrogatory?

13 A. Yes, but it had been revised at the
14 time of that interrogatory. As I say, we do three or
15 four forecasts a year.

16 Taking either figure, Darlington again
17 was the major contributor. Darlington contributed
18 almost 9 terawatthours to the difference. Our
19 assessment of the fuel problem in May of '91, we had
20 not anticipated such long delays on Darlington 2, and
21 the subsequent appearance of this problem with
22 Darlington 1. So we hadn't fully anticipated the
23 extent of the problems at Darlington.

24 Also another contributor was Bruce "A"
25 where at the time of doing the forecast we had cleaned

1 the steam generators, performance was good, but as we
2 discussed earlier we did run into some boiler tube
3 leaks later in the year.

4 So the Bruce steam generators were a
5 contributor to that difference. Those problems largely
6 emerging in the second half of '91.

7 Q. Now, given the probabilities that you
8 gave us in those interrogatories, would you agree that
9 your view of the probability of falling 5 terawatthours
10 short of the forecast for two years in a row would have
11 been 1 in 40? In other words, the 10 per cent chance
12 1991 hearings and the 25 per cent of the 1992 hearings?
13 [10:43 a.m.]

14 A. So you are just multiplying these two
15 together?

16 Q. Right. Is that fair? That's a
17 probability of falling that short two years in a row
18 given those respective probabilities?

19 A. Yes, based on those two. Yes.

20 Q. And those probabilities were based on
21 Ontario Hydro's best judgments?

22 A. The best judgments at that time, yes,
23 and I think they should be taken in the context of we
24 were bringing in a major generating station like
25 Darlington and surprises in the early years of a major

1 generating station are not uncommon. We did have a
2 pretty major surprise at Darlington that did throw off
3 the forecast, and we have had to make adjustments to
4 the forecasts since that time.

5 Q. And we are talking about a time span
6 of one year ahead and then you make other forecasts
7 that are even less in time ahead of the forecast dates?

8 A. That's true but some periods of
9 operation are more difficult to forecast than others.
10 I would say early performance on a new station, new
11 design, you are a little more vulnerable to surprises.
12 Other times where you are vulnerable to surprises are
13 if you are getting into a particular type of work, such
14 as retubing that we get into '93 that we have not been
15 into before.

16 So when we are doing those first of a
17 kind outages on pressure tubes and steam generators our
18 depth of knowledge is not very, is not very great, and
19 some of the forecasts certainly were out. But as we
20 have gained experience, in particular, in retubing and
21 doing pressure tube work, our ability to forecast and
22 plan pressure tube work has been improving over the
23 years. But until we get through the, if you like, the
24 first cycle of tackling those particular types of
25 outages or starting up new generating stations, we have

1 some vulnerability to this type of surprise.

2 Q. And as we see, these surprises and
3 these extra uncertainties from first of the time
4 outages and other occurrences were not built into these
5 forecasts; right?

6 A. They were built in to some extent.
7 Obviously particularly in the case of Darlington they
8 were not built in sufficiently. We simply did not
9 anticipate the fuel problem that occurred at
10 Darlington, and if you are forecasting 70 to 80 per
11 cent from a number of units and neither of those units
12 produce you are going to have a large gap in your
13 forecast.

14 Q. Would it be fair to say that the
15 uncertainties regarding forecasts for one year ahead
16 are great according to these forecasts and the evidence
17 that you have just given? That there are great
18 uncertainties?

19 A. Well, I think what we have said, for
20 example, you haven't included the second page of the
21 main submission to the 1993 rate hearing, but we do go
22 on to say that there is significant uncertainty at this
23 time with Darlington, for example, and when we discuss
24 this with the OEB this year we will point out the
25 uncertainty facing Darlington.

1 I might say that in our forecasting
2 process we produce point values, such as we have been
3 describing, but when we discuss them with system
4 planning and the power system operations division, we
5 discuss the range of the forecast, and the
6 sensitivities and the contingencies, and the potential
7 surprises. So when we are discussing this with other
8 people within the corporation, we are aware that
9 although our forecast says value X, there is a range
10 around that. There are some potential surprises, and
11 on the divisions like system planning and power systems
12 operations division, you know, take account of these
13 things and make what they believe to be appropriate
14 judgments.

15 So I think the numbers have to be viewed
16 in the context of we don't just use the numbers, we use
17 a range and we have discussions on likely surprises.

18 Q. Now these probabilities that were
19 given just recently and last year were based on Ontario
20 Hydro's best available judgments for the one year
21 period, and didn't take account of some of these
22 surprises that you have told us about. So is it fair
23 to say that it's very, very difficult to make any
24 forecasts at all with any agree of reliability about
25 production not one year ahead but 22 years ahead?

1 A. Well, forecasting is never that easy
2 in any, in any field and nobody -- I don't know of
3 anybody who can accurately foretell the future. What
4 we have to do in forecasting is adjust based on our
5 experience and where we have had a surprise make sure
6 that we, we correct as necessary and try and anticipate
7 future surprises.

8 I think we have been doing that. In 1991
9 just past our forecast was for the "A" and "B" stations
10 combined was actually slightly higher, about 2 or 3 per
11 cent higher than our budget level indicating that we
12 had made the corrections on the "A" and "B" stations
13 combined. Darlington we had not made the correction
14 required and that brought us below the forecast level.
15 So I think we have, we have to look at what's
16 contributed to the, the past errors in forecasting and
17 make the corrections. I think -- I am largely
18 confident that we have made the corrections on the, on
19 the "A" stations. Darlington we have, we have
20 certainly a short-term problem there that we have to
21 get around.

22 Q. Now in the 1991 one year ahead
23 forecast we saw that the forecast was 80.7
24 terawatthours and then we saw that it was actually 68.7
25 terawatthours. In the 1992 one year ahead forecast was

1 81.5 terawatthours, and now the current prediction is
2 66 terawatthours?

3 A. Correct.

4 Q. And now I notice that the 1993 one
5 year ahead forecast is 82.4 terawatthours; is that
6 right?

7 A. Yes.

8 Q. And that's a forecast that's taken
9 into account everything you have learned from earlier
10 years forecasting and the surprises you have told us
11 about?

12 A. That's correct, however, I would like
13 to read into the record -- you have included page 32 of
14 the submission to the OEB, which has this figure, and
15 on page 33 we have a paragraph to assist the OEB saying
16 paragraph 5 of page 33,

17 There is considerable uncertainty
18 associated with the forecast level of
19 nuclear production. This primarily
20 results from difficulty in accurately
21 predicting the success of the plan
22 modification to the primary heat
23 transport pumps to resolve the damaged
24 fuel at Darlington.

25 So we agree there is significant

1 uncertainty in that figure for '93. There are four
2 Darlington units due to go into service within a very
3 short period because of the delays on Units 1 and 2.
4 Units 3 and 4 have been commissioning recently
5 normally, so we now have all four units in a very short
6 time period, and if the seven vein impeller fix turns
7 out to be successful, then all four units should be
8 into operation very smartly. If the impeller fix is
9 not successful then, as I indicated in my direct
10 evidence, there will be further delays.

11 So, this is not a typical situation for
12 us. This is a rather unusual situation in '93 where we
13 have four units whose production is affected by this
14 one modification, and we will not know until probably
15 June or July how successful that modification is going
16 to be. So when I was discussing this earlier I said,
17 okay, we do provide specific figures, but we will also,
18 in discussing with OEB and other users of our
19 forecasts, the uncertainty behind it and the
20 sensitivities and contingencies, and so on.

21 Q. All right. So what, in your
22 judgment, would be the probability of the 1993
23 production actually being 5 terawatthours or 10
24 terawatthours, or 15 terawatthours less than 82.4?

25 A. I haven't done that calculation.

1 Perhaps I might anticipate it as an OEB interrogatory.

2 Q. That's fair.

3 A. I think my general answer to that
4 would be to quote the two sets of Darlington in-service
5 dates we are using in our business plans. One assuming
6 the fix works and one assuming it doesn't.

7 Q. So is it fair to say that what you
8 are saying is that there is major uncertainty about
9 this figure and so the probability of being, for
10 example, 5 terawatthours less than 82.4 is quite high?

11 A. No, I wouldn't say that at this
12 stage. I think that's our best opinion, best judgment
13 at this point in time. As the laboratory tests and
14 tests on Darlington 3 and 4 over the April, May, June
15 period, as we go through those tests, then we will have
16 a much better handle on this figure.

17 Q. I would like to turn, if I could, to
18 slide 16 from your direct evidence.

19 THE CHAIRMAN: Sorry which number?

20 MS. McCLENAGHAN: Slide 16, from Exhibit
21 519.

22 THE CHAIRMAN: Do you want it put up?

23 MS. McCLENAGHAN: Oh yes please. If
24 that's possible.

25 Q. Now I would like to confirm that

1 Hydro no longer stands by its evidence from earlier in
2 the hearing about long-term nuclear prospects and, in
3 particular, we notice that your forecasts for the "A"
4 stations in slide 16 from your direct evidence show
5 production at very much lower than the forecasts shown
6 in Exhibit 148 from Panel 2, which are at page 47 of
7 our materials.

8 THE CHAIRMAN: 47 did you say?

9 MS. McCLENAGHAN: Yes that's page 47 of
10 our materials and that was Interrogatory 2.2.22 which
11 was Exhibit 148.

12 MR. DALY: Well, I'm not sure in what
13 context this was discussed or described or put forward.
14 Was Panel 2 before the Update?

15 THE CHAIRMAN: Yes, well before.

16 MR. DALY: Okay. So this was an earlier
17 forecast done before the Update and as we have
18 discussed, I think particularly with the Coalition, the
19 forecast used in the Update was a later forecast and
20 that was built into the Update and that was the
21 forecast I provided in my direct evidence. And, yes,
22 it is lower than the forecast used in the original DSP
23 sort of averaged between 5 and 10 per cent reflecting
24 the need for us to adjust our forecast based on
25 experience.

1 MS. McCLENAGHAN: Q. And so as you
2 indicated in slide 16, the forecast now doesn't ever
3 get to 80 per cent for Pickering "A"; is that right?

4 MR. DALY: A. Okay, yes. Again what we
5 are portraying here is an average forecast that we
6 think will reflect average performance. That's within
7 a range and we would naturally expect some years to be
8 better than average and some years lower.

9 [10:55 a.m.]

10 But on average, you are correct, we are
11 now showing it as slightly below 80 per cent on
12 average.

13 Q. Now, in terms of the forecast that's
14 shown on slide 16, wouldn't you agree that aging would
15 cut production in the last decade of life?

16 A. Not necessarily, I think the CANDU
17 reactors are somewhat unique in that although -- and I
18 am referring particularly to the retubing outages where
19 we have to retube sometime in mid-life, in the earlier
20 plants around year 13 to 15, and perhaps in the later
21 units around year 30. So I think that the retubing
22 outage certainly takes some time, typically of the
23 order of two years at the moment. But what it does
24 give us is a rather unique opportunity to do a lot of
25 mid-life maintenance, corrective maintenance,

1 upgrading, rehabilitation, and so on.

2 So I think without that opportunity it
3 would certainly be difficult to fight off aging. But I
4 think given that opportunity to do that type of work,
5 in my view of the CANDU reactor - well, I guess time
6 will obviously tell in this - but I think CANDU
7 reactors have a rather unique feature there which I
8 think should benefit them well in fighting the effects
9 of aging.

10 Q. Wouldn't you agree that that outlook
11 is contradictory to your corporate reference plan which
12 we looked at yesterday and particularly page 7, which
13 indicated in the --

14 THE CHAIRMAN: Sorry, page 7?

15 MS. McCLENAGHAN: Page 7.

16 THE CHAIRMAN: Of what document?

17 MS. McCLENAGHAN: It's this exhibit
18 package, 612, but that was given its own exhibit, 614.

19 THE CHAIRMAN: So page 7 of 612?

20 MS. McCLENAGHAN: That's right.

21 MR. DALY: No, I wouldn't agree.

22 If you read the whole paragraph I think
23 what it said was a reduction reliability due to general
24 equipment aging is of concern, and I indicated
25 yesterday as a general statement that's fair.

1 But moving on to the end of that
2 sentence, an ability to for case equipment life in
3 order to take preventive measures ahead of time is
4 essential if adequate performance is to be maintained.

5 The paragraph then goes on to talk about,
6 given this, what are we doing about it?

7 So I think the important thing is, first
8 of all, to recognize the potential, but then put in
9 place programs such as the nuclear plant life assurance
10 program and the rehabilitation programs to address it.

11 As I say, I think we have a unique
12 opportunity in CANDU to do this type of preventative
13 maintenance during that, particularly during the
14 retubing outages.

15 MS. McCLENAGHAN: Q. Now, as I
16 understand it, at one time, in fact until very recently
17 performance at 85 per cent capability factors was your
18 forecast, not your target for "A" stations post
19 retubing; is that right? I refer you to page 48 of our
20 materials.

21 MR. DALY: A. Well then, if I read from
22 the bottom line of that page, yes, certainly in those
23 two particular years, '93, '94, we had at that time
24 forecast 86.2 percentage and 85.8 per cent.

25 The 85 per cent post retube remains as a

1 target. Our forecast for different plants may be more
2 or less than that, depending on particular years,
3 particular circumstances.

4 Q. But my question was, though, that it
5 wasn't previously a target; it was a forecast, as, for
6 example, on page 48 of the material.

7 A. You are only showing there a
8 forecast -- well, for those two years, post retube,
9 yes, at that time.

10 I look upon 85 per cent, I think you
11 really have to look on a longer time scale than just
12 two years.

13 Q. Now, if you want to look at more than
14 two years I notice that the forecasts went on between
15 1989 and 1994 with a forecast for each year, and for
16 the most part the forecasts were in the mid-eighties,
17 sometimes the high eighties, sometimes the low
18 eighties, and once at 77.9; is that right?

19 A. I'm sorry, which page are you reading
20 from?

21 Q. Page 48, under Pickering 1 and
22 Pickering 2, capability factor.

23 A. Sorry. Yes, you are correct. I was
24 reading from the bottom line which was the Pickering
25 "A" average.

1 Yes, certainly for Pickering 1 and 2, at
2 that time these were our forecasts. As you indicate in
3 this chart, we have since adjusted the forecasts. I
4 have the updated forecasts in front of me, and there
5 are a few years where we come close to 85 per cent in
6 specific years, but the overall average has dropped
7 somewhat.

8 Q. And we see at page 7, again the
9 corporate reference plan, that the present post retube
10 capability is averaging about 74 per cent; is that
11 right?

12 A. That's correct. The most up-to-date
13 figure I have is 75 per cent as an average from
14 Pickering 1, 2 and 3 post retube.

15 Q. The sentence before that, this is the
16 third point under challenges for the future, second
17 last sentence indicated:

18 The Pickering "A" units received
19 limited rehabilitation during their
20 retubing outages and to date have not
21 achieved the 85 per cent post retube
22 capability required.

23 And so it would appear to me that the
24 word required indicates that 85 per cent wasn't a
25 target, but isn't it fair to say that it was a required

1 result of retubing because it was part of how Ontario
2 Hydro justified the retubing?

3 A. I don't recall offhand whether that
4 figure was used back in -- no. It wasn't used in that
5 context.

6 The retubing, as we indicated earlier,
7 was a surprise when started in '93. So it wasn't a
8 case in 1983 that we had planned to do the retubing in
9 order to get 85 per cent post retube. We were forced
10 into that particular outage.

11 However it's true to reflect 85 per cent
12 as a target that we want to get to, and we are not
13 satisfied with the current 75 per cent and we made some
14 modifications to the rehabilitation work on Unit 3, as
15 a result of the Units 1 and 2 experience. So we are
16 still striving to get beyond the 75 per cent we are
17 currently at.

18 Q. Now, I would like to turn next to the
19 economics of retubing Bruce "A" units, and the issue as
20 to whether the retubing is worth doing. I would like
21 to turn you to page 49 of our materials, which is
22 Interrogatory No. 9.2.131.

23 THE REGISTRAR: That has previously been
24 filed as 520.4

25 MS. McCLENAGHAN: Q. Now, first of all,

1 the answer, which begins at page 50, provided an
2 analysis for Bruce "A" as a whole, although the
3 question was the economics of retubing and other plant
4 repairs for each Bruce "A" unit.

5 It may be that some units are more
6 unjustified or justified than others; isn't that fair,
7 in terms of whether they are worth retubing?

8 THE CHAIRMAN: Where are you looking at?

9 MS. MCCLENAGHAN: I haven't made a
10 specific reference yet, Mr. Chairman.

11 MR. PENN: I don't think that's the case
12 at all.

13 MS. MCCLENAGHAN: Q. The interrogatory
14 question at page 49 was to: Please provide Hydro's
15 best analysis of the economics of retubing and other
16 planned repairs of each Bruce "A" unit.

17 MR. PENN: A. Yes.

18 Q. Then the response is an attached
19 decision analysis summary on page 50 containing the
20 Bruce "A" rehabilitation program summary.

21 A. Yes.

22 Q. Now, I understand that Hydro based
23 the economic analysis of Bruce "A" retubing assuming an
24 85 per cent capability factor post retubing as is
25 suggested on page 50 in the first paragraph; is that

1 right?

2 A. That was the target, yes.

3 Q. So this means that after retubing you
4 have assumed you would have an 85 per cent capability
5 factor?

6 A. Well that, as it states, and I am
7 looking at page 50 now, is the required result that we
8 are looking for, under item 2.

9 MR. DALY: A. I might just add to that
10 that certainly as Mr. Penn says, the target, in some of
11 our forecast and economic analysis, we haven't taken a
12 full credit for getting to 85 per cent. We have taken
13 lower values in some cases and it should be viewed in
14 that light.

15 Q. Right. But you are indicating, Mr.
16 Penn, that 85 per cent is the required result from the
17 Bruce retubing program?

18 MR. PENN: A. From both the retubing and
19 the rehabilitation program that's described in this
20 interrogatory.

21 Q. Now, I would like to refer you to
22 your slide 18 from your direct evidence. I wonder if
23 it could be put up, please.

24 Now that indicates a forecast of less
25 than 80 per cent for Bruce "A" and it is actually a

1 maximum of 75 per cent; is that right?

2 MR. DALY: A. I believe we did provide a
3 breakdown of those figures. I would just like to quote
4 you the source. Just for reference, Interrogatory
5 9.7.535, we did provide the actual numbers behind that.
6 But I think you are right, it's about 75 per cent. And
7 the reason for that is, as I described earlier on in my
8 direct evidence, we have targets and forecasts, and
9 within our forecasts we provide our forecast with a
10 range of the forecast to various users, and particular
11 users may take values in the upper part of the range,
12 particular users may take values in the lower part of
13 the range, depending on the purpose they are going to
14 use the forecast for.

15 In this particular case we provided our
16 forecast with the range to system planning and also
17 discussed the range with them, discussed the
18 sensitivities, the contingencies, and they felt that
19 for the purposes of this particular plan, taking all
20 things into consideration, these were the most
21 appropriate values to use.

22 That does not in any way detract from the
23 fact that it is our clear target to get to 85 per cent
24 post retube, and we will do everything to get to that
25 value. It's not uncommon to have that sort of

1 difference between management targets and what you
2 might want to assume as a median forecast for a
3 particular purpose.

4 THE CHAIRMAN: 9.7.535.

5 THE REGISTRAR: That is .107.

6 ---EXHIBIT NO. 520.107: Interrogatory No. 9.7.535.

7 MS. McCLENAGHAN: Q. Now, it seems to me
8 that you have indicated, or it's been indicated in the
9 decision analysis summary for the Bruce "A"
10 rehabilitation program on page 50, that the required
11 results after retubing and rehabilitation are 85 per
12 cent operating capability in order to meet the goal of
13 Bruce "A" attaining a 74 per cent average lifetime
14 capability factor; is that right?

15 MR. DALY: A. Correct.

16 Q. And are you able to justify that
17 assumption given that Pickering 1 and 2 have only
18 achieved 74 per cent post retubing, and given this
19 slide which shows maximum annual capability factors of
20 75 per cent?

21 A. Well, a couple of points on that.
22 The Pickering rehabilitation was a much smaller scale
23 rehabilitation than what is planned for Bruce "A". As
24 a result of our experience in Pickering "A", it became
25 evident that we have needed to do more during the

1 rehabilitation period.

2 So I think given that Pickering has
3 achieved, to date over a fairly small number of years,
4 75 per cent the fact that we are going to do a
5 substantially larger rehabilitation program at Bruce
6 "A", I think these are a couple of the factors that
7 need to be taken into account when assessing the Bruce
8 "A" projections.

9 As I mentioned, there is this distinction
10 between the forecasts you use for planning purposes and
11 the targets and the economic analysis. This economic
12 analysis was that provided to the board of directors
13 did discuss various sensitivity analyses, for example,
14 in section 7.2 on page 13 -- sorry. On page 12 of the
15 analysis, the various risks and uncertainties were
16 discussed and provided there, some of which were
17 additional outage time caused by the rehab program
18 under item 4, and capability factor under-achievement.

19 So in producing this document, system
20 planning did look at a wide range of potential
21 capability factor improvements and it's certainly not
22 necessary from an economic point of view to get the
23 full 25 per cent improvement that Mr. Penn described.

24 The break-even point that system planning
25 came up with was about 9 per cent incapability factor

1 as shown on page 13.

2 Q. And on page 12, which you were just
3 referring to under the title Risks, it indicates that
4 the fifth risk is capability factor under-achievement
5 after rehabilitation?

6 A. Yes.

7 Q. It indicates it's considered a 25 per
8 cent probability and that it would diminish the
9 economics of rehabilitation; right?

10 [11:18 a.m.]

11 A. That's correct. And in their studies
12 system planning did look at that type of sensitivity.

13 Q. Now I would like to turn to page 62,
14 which is page 13 of the rehabilitation program.

15 Perhaps, Mr. Chairman, this particular
16 document should be given it's own exhibit number. Oh
17 it's -- okay. Sorry. It's part of the interrogatory.

18 THE CHAIRMAN: I think it's 50 through to
19 the interrogatory.

20 MS. McCLENAGHAN: Yes, that's fine. I'm
21 sorry.

22 THE CHAIRMAN: In fact, it's the only
23 thing in the interrogatory.

24 MS. McCLENAGHAN: Q. Page 62 indicates
25 the authors of the report are indicating a probability

1 of having to replace boilers at 10 per cent. Do you
2 see that?

3 MR. KING: A. Yes.

4 Q. And my question is, isn't the
5 likelihood of having to replace the boilers in Unit 2
6 only much higher than it is for the whole station?

7 MR. PENN: A. Sorry? Could you repeat
8 that question, please?

9 Q. Right. Isn't the likelihood of
10 replacing the boilers in Unit 2 much higher than it is
11 for the rest of the station or for the whole station?

12 A. It's higher, yes.

13 Q. And is it higher than 10 per cent?

14 A. I have no reason at this point in
15 time, with the knowledge we have, to make any different
16 figure than that. I think I testified earlier this
17 morning that it may be that all we will have to do is
18 rehabilitate the boilers, particularly the one of eight
19 boilers on Unit 2 that had this lead blanket left in
20 it.

21 It may be as simple -- maybe I shouldn't
22 say simple, but as straightforward as modifying the
23 tubing at the top of that boiler and proceeding and not
24 replacing it at all.

25 Q. The next area I would like to turn to

1 is nuclear performance and nuclear powers impact on
2 rates. And, Mr. Penn, accounting unit energy costs
3 represents the impact of a generating unit on rates; is
4 that right?

5 A. I'm sorry, I don't know the context
6 in which you are asking this question.

7 Q. Well, first of all, just the term.
8 Is that not fair that the phrase AUEC represents the
9 impact of a generating unit on rates?

10 A. Well, as I testified before and, I
11 believe, Panel 3 went into these definitions at
12 considerable length. I think it was Mr. Snelson.
13 Accounting unit energy cost is synonymous with total
14 unit energy cost, which my direct evidence described in
15 detail with respect to the future generating costs of
16 our nuclear system, so is it used for rate setting?
17 It's part of the process, yes, it is not the only thing
18 that is used for rate setting.

19 Q. I understand that you were part of
20 the team that made presentations to the Ontario Nuclear
21 Cost Inquiry in 1988; is that right?

22 A. I was part of the team that made
23 those presentations. Yes.

24 Q. And at page 68 of our materials -
25 which I believe we have as an exhibit - this was a

1 presentation to the Ontario Nuclear Cost Inquiry
2 regarding the pattern of accounting unit energy cost in
3 real dollars over time; is that right?

4 A. Well, this was a presentation made by
5 Mr. Snelson on Cost Methods for Decision-Making. That
6 was the title of the chapter.

7 Q. All right. It indicates that the
8 accounting unit energy cost would decrease over time to
9 the end of the 40 year life of the generating station;
10 is that right?

11 A. That's correct.

12 Q. Now on page 68, part of that
13 presentation at .3 indicated that in constant dollars
14 it showed the downward trend with time?

15 A. Yes, it is showing a figure of 9.5.

16 Q. Right. Page 69 is from the Ontario
17 Nuclear Cost Inquiry report. It's page 69 of the same
18 exhibit package we have been working from, 612.

19 A. This is an excerpt from Exhibit 44,
20 and the ONCI inquiry is Exhibit 43, and page 68 of that
21 doesn't have that graph on it, so I'm a bit confused at
22 the moment. I am looking at, it says figure 9.1, page
23 68 at the bottom, and I'm saying that that is not the
24 page in the ONCI inquiry.

25 Q. Mr. Penn, page 68 is an excerpt from

1 Ontario Hydro's presentations to the Ontario Nuclear
2 Cost Inquiry, and the next page is an excerpt from the
3 report of the Ontario Nuclear Cost Inquiry, Exhibit 44.

4 A. Well, I'm looking at the report --
5 Oh, so you are referring to the report to the
6 government?

7 Q. I am now turning to the report
8 itself, yes. I'm sorry for the confusion.

9 A. Oh, that's Exhibit 44 then?

10 Q. Right.

11 A. Thank you and page 68 of that. Yes.

12 Q. Is it fair to say that that graph on
13 page 69 of our material, or page 68 of the report,
14 which I guess you are looking at, is a somewhat more
15 sophisticated version of the graph that was in Hydro's
16 material because it includes accounting for retubing
17 costs?

18 A. Well, subject to check, I note that
19 this of course is for a new station, a 4 by 881
20 megawatt assumed to be in-service in the year 2002, and
21 it shows the accounting unit energy cost increasing
22 from about the year 2029. So I would assume that you
23 are probably right, that that increase in AUEC takes
24 account of retubing.

25 Q. All right. And would you agree that

1 other than that, that the Ontario Nuclear Cost Inquiry
2 generally accepted Hydro's view that the expected trend
3 of accounting unit energy costs over time is downward?

4 A. Yes.

5 Q. Now I would like to turn you to page
6 70 of our materials.

7 A. And there are very good reasons for
8 that as I gave in my direct evidence.

9 Q. Right. I would like to turn you to
10 page 70 of our material, which is Interrogatory
11 response 9.2.102.

12 THE REGISTRAR: What was that
13 interrogatory?

14 MS. McCLENAGHAN: Page 70 of our material
15 9.2.102.

16 THE REGISTRAR: That has the number .103.

17 ---EXHIBIT NO. 520.103: Interrogatory No. 9.2.102.

18 MR. PENN: Before we leave your page 69,
19 I would like to note for the record that there is a
20 full description of that figure on page 67 of Exhibit
21 44, in which it talks about how the AUEC is calculated.
22 It talks about straight line depreciation policy with
23 interest contributes to the decrease in AUEC over the
24 life of the station when expressed in '88 dollars, and
25 it states that the hump near 2032 is due to large scale

1 fuel channel replacement and station rehabilitation, so
2 it is fully described.

3 MS. MCCLENAGHAN: Q. All right. Now in
4 terms of Interrogatory No. 9.2.102 at page 70, Ontario
5 Hydro provided the total unit energy costs or
6 accounting unit energy costs for all of Ontario Hydro's
7 nuclear stations in both dollars of the year
8 megawatthour and constant 1990 dollars per
9 megawatthour, and we have prepared a graph based on
10 that data for Pickering "A" and "B" using the same
11 format as the graphs we have just looked at which Hydro
12 presented to ONCI, and the graph is contained at page
13 73 of our package.

14 We had given this graph to you sometime
15 ago, Mr. Penn. I understand you have had an
16 opportunity to review it; is that right?

17 MR. PENN: A. Well, I can honestly say I
18 haven't reviewed it. I have reviewed the other 600
19 pages of material you gave me since last Friday
20 afternoon, but I hadn't got as far as this one.

21 Q. All right, but this was provided
22 before we began our cross-examination. In any event,
23 maybe this is a time for --

24 THE CHAIRMAN: We will take a break and
25 that will give him at least 15 minutes. It may not be

1 long enough, but we will give him 15 minutes to look at
2 the graph.

3 THE REGISTRAR: Please come to order.

4 The hearing will recess for 15 minutes.

5 ---Recess at 11:32 a.m.

6 ---On resuming at 11:50 a.m.

7 THE REGISTRAR: Please come to order.

8 This hearing is again in session. Please be seated.

9 THE CHAIRMAN: Ms. McClenaghan?

10 MS. MCCLENAGHAN: Thank you, Mr.

11 Chairman.

12 Q. Mr. Penn, I take it you have had a
13 brief opportunity over the break to look at the graph
14 contained on page 73 of the material, which is prepared
15 based on the data which was provided to us in
16 Interrogatory 9.2.102, and do you agree that the figure
17 appears correct and presents the data in a constant
18 dollar of AUEC against reactor age?

19 MR. PENN: A. Well, I think it is
20 appropriate to point out that this graph has been
21 plotted from data provided in Exhibit 520.103, which
22 was given in dollars of the year spent for each of
23 Pickering "A" and Bruce "A" from the years that it went
24 into service.

25 The second thing to point out is that

1 then these are being converted to constant dollars in
2 1990 dollars per megawatthour electrical.

3 And a third thing to point out is that
4 the age that's been used to plot this, it's not clear
5 to me whether it is in calendar years or whether it's
6 in 12 month intervals.

7 But apart from those comments, and
8 assuming that Energy Probe has used the appropriate
9 discount factors and escalation factors to do this
10 constant dollar calculation, I will assume that it is
11 right.

12 Q. First of all, with respect to the
13 first question, I will put it to you that you can
14 assume that it used calendar years, not reactor years,
15 and secondly that it used know discount factors nor
16 escalation factors, but rather was based on the data
17 that Ontario Hydro provided in this interrogatory
18 response on page 72.

19 A. Well, as I pointed out -- wait a
20 minute. Thank you for pointing that out. I hadn't
21 noticed that we had tables both in dollars of the year
22 and constant dollars. Thank you.

23 DR. CONNELL: I would like to ask if the
24 tables and the graph include the period of the initial
25 capital expenditure?

1 MR. PENN: They would, Dr. Connell, on
2 the basis that the units would be depreciated from the
3 data being placed in-service, each of them separately
4 on a straight line basis.

5 Now there would be a recognition that I
6 think in the early days the life of a depreciation was
7 30 years and I think we changed to a 40-year
8 depreciated life somewhere around about the late 70s.

9 DR. CONNELL: But Pickering appears to
10 start at year 4 on the graph and Bruce at year 1. Why
11 is that?

12 MR. PENN: I don't know why that is.
13 It's not my graph.

14 MS. MCCLENAGHAN: Q. This is based on
15 the data that was provided from Ontario Hydro for those
16 years, on page 72, and the data provided by Ontario
17 Hydro began for Pickering "A" in 1974 and for Bruce "A"
18 in 1977.

19 Is it fair to assume, Mr. Penn, that the
20 reason that Ontario Hydro provided this data to us from
21 those commencement dates is because of the problems
22 with strikes and over-rolled end joints which occurred
23 before 1974?

24 MR. PENN: A. I am afraid I don't know.

25 MR. DALY: A. I can't comment on the

1 actual reason. That's possible.

2 Certainly Pickering started in 1971 and
3 there was that strike, as you mentioned in '72, quite a
4 long strike, so the '72 numbers would not be very
5 representative of anything.

6 I suspect that was generally the reason.

7 Q. Now, Mr. Penn, my question simply
8 was: Would you agree that the graph on page 73
9 accurately presents the data which was given to us by
10 Ontario Hydro from page 72?

11 MR. PENN: A. Well, on the basis that it
12 has been plotted correctly, yes.

13 Q. And would you agree that Hydro's
14 actual experience with "A" stations doesn't bear any
15 relationship to the expected trend you presented to
16 ONCI which we saw a couple of minutes ago in slide
17 16 -- from page 69, excuse me?

18 A. Yes. Well, as we went over before
19 the break, this graph on page 69 of your Exhibit 612 is
20 taken from Exhibit 44, and this is for a future station
21 where it is expected that retubing would occur around
22 about year 30. As we discussed, that's why AUEC
23 increases on that graph.

24 Now, if we go to your graph on page 73,
25 retubing of Pickering "A" occurred at year 12, starting

1 at year 12, not at year 30. So given that this has
2 been plotted correctly, I don't think it's surprising
3 to us at all that you could see this trend, because for
4 Pickering "A" that increase in constant dollars would
5 be directly affected by the retubing because obviously
6 the megawatthours produced by the station would be very
7 much lower. And similarly for Bruce, I think we have
8 given evidence, Bruce "A", we have given evidence of
9 the increasing OM&A costs from 1988 onwards, and we
10 have talked about the steam generator issues, and we
11 have talked about the inspection of pressure tubes to
12 determine their condition, and I think that explains
13 this graph.

14 Q. So you would agree that although the
15 first six or seven years resemble the expected pattern
16 that you presented to ONCI, after that the curve
17 departs from the expected pattern and the costs
18 increase for all of the reasons that you have just been
19 mentioning, and Bruce hasn't been subject to retubing
20 in this graph; right?

21 A. That's quite right, and you would
22 expect that. And as soon as you have retubed Pickering
23 "A" and you are generating a large number of
24 megawatthours, you would expect the actual AUEC in
25 constant dollars, 1990 dollars, to reduce considerably,

1 and continue its trend downwards as you proceed to end
2 of life.

3 Q. And so is it fair to say that the
4 actual cost to ratepayers of the "A" stations has
5 greatly exceeded the expected pattern of smoothly
6 downward sloping rates in light of the real experience?

7 A. Well, the policy of Ontario Hydro is
8 to equitably charge the customers of the day the cost
9 of producing power. We operate on a principle of power
10 at cost. And obviously if you retube reactors at this
11 given time, the customer bears that cost.

12 Q. And similarly for Bruce, even without
13 retubing, the customer has borne those costs as well.

14 A. For the reasons I have stated.

15 DR. CONNELL: I expect we have covered
16 this before, but is the retubing not capitalized?

17 MR. PENN: Yes, it is, sir. And then
18 it's depreciated over the remaining life of the
19 station.

20 All capital modifications, whether they
21 are retubing or whether they are rehabilitation or
22 whether they are improvements in safety systems, are
23 capitalized.

24 DR. CONNELL: I am not sure then why the
25 Pickering "A" experience should appear as a spike if

1 that capital is distributed over the remaining life, or
2 why is there a sharp trough occurring in year 17 or 18
3 as it appears on the graph?

4 MR. PENN: Yes, I agree, Dr. Connell.

5 The peak that proceeds that trough would be related to
6 the fact that we had Pickering Units 1 and 2 not
7 generating any power for a period of four to five
8 years. So that the whole megawatthours from Pickering
9 "A" would be that coming from Units 3 and 4. I presume
10 the reduction is due to the in-service of Units 1 and
11 2, and just having Pickering 3 out-of-service, but
12 having three units operating.

13 DR. CONNELL: Yes. So the spike is
14 really a downward spike in megawatts rather than an
15 upward spike in dollars.

16 MR. PENN: Yes, because that has enormous
17 leverage on this parameter on the vertical axis.

18 DR. CONNELL: Thank you.

19 MS. MCCLENAGHAN: Q. I wonder if you
20 could put up slide 76. Page 76 of our materials is the
21 slide which will be put up, and we gave Ontario Hydro
22 some notice of the following question, Mr. Penn, by a
23 letter of March 31st, which is: What was Darlington
24 2's total unit energy costs for the first year of its
25 operation?

1 MR. DALY: A. We did a calculation for
2 Darlington based on the first year of service, October
3 9th, 1990 to October 8th, '91, an approximate
4 calculation. The figure was 47 cents per kilowatthour.
5 Now that reflects the fact that Darlington Unit 2 in
6 its first year of operation operated for around three
7 months before it was shut down because of the fuel
8 handling problems.

9 So again like the previous discussion we
10 have had on Pickering, the fact that the TUEC is as
11 high as 47 is substantially affected by the low
12 production of Darlington 2 in its first in-service
13 year.

14 Q. The figure that's up on the slide
15 from page 76 of the materials is part of the attachment
16 to Interrogatory 9.2.45 and page 75 of the material.

17 THE REGISTRAR: 9.2.45, that's previously
18 entered, 520.36.

19 MS. McCLENAGHAN: Thank you.

20 Q. That was a document titled Total Unit
21 Energy Cost Projection for Existing and Committed
22 Fossil and Nuclear Stations, May 1988, and it
23 indicated, Mr. Daly, for Darlington, would it be fair
24 to say that the projection was in 1990/1991 about 7
25 cents a kilowatthour, if you convert mills to cents?

1 MR. DALY: A. Yes.

2 Q. And if you were to draw the 47 cents
3 a kilowatthour for that time period that you just
4 indicated was the actual cost on the graph, is it fair
5 to say that you would have to go to the top of the
6 page?

7 A. Yes, it would be very high because of
8 the lack of production in its first year.

9 Q. I would like to turn to page 77 of
10 our materials which is Interrogatory 9.2.44.

11 THE REGISTRAR: 9.2.44 is .102.

12 ---EXHIBIT NO. 520.102: Interrogatory No. 9.2.44.

13 MS. McCLENAGHAN: Q. And that deals with
14 the Pickering payback agreement.

15 Mr. Daly, would you be able to explain to
16 us what the Pickering payback agreement is?

17 MR. DALY: A. I have only a general
18 knowledge of it. I don't think I could add very much
19 more to what is in the response to the interrogatory.

20 This was a joint undertaking between
21 Ontario Hydro, AECL and the Province of Ontario. And
22 contributions to the capital cost of Pickering Units 1
23 and 2 were made by AECL and the Province of Ontario,
24 and as indicated in the response to the interrogatory
25 amounted to some 258 million.

1 Ontario Hydro was required as part of the
2 contract to pay back to AECL and the province various
3 amounts depending on the what you might call the net
4 advantage of Pickering Units 1 and 2, compared with
5 power generated by coal-fired units similar to Lambton
6 Units 1 and 2. That's the paragraph just below the
7 numbers.

8 So since the startup of Pickering,
9 Ontario Hydro has been paying back to AECL and the
10 Province of Ontario various amounts depending on the
11 performance of Pickering, relative to Lambton.

12 Q. So in the table on page 78 where it
13 indicates a payback and an amount for each year, is it
14 fair to say that the negative numbers are, in effect,
15 net negative advantages or, in other words,
16 disadvantages compared to Lambton?

17 A. They are disadvantages. During that
18 period costs were high and energy was low. This is the
19 period of retubing, basically '83 to '88, with most of
20 it being in '84 to '87. So the calculation which was
21 part of the contract ended up with negative payback
22 during those four years.

23 Q. And how is a negative payback
24 accounted for?

25 A. Well, my understanding of it, and it

1 is also identified in an interrogatory here is that
2 it's accrued. And effectively as Pickering returns to
3 service and the payback numbers get into the positive
4 range, then the negative payback is, if you like, taken
5 off the future positives.

6 There was a lot of discussion and debate
7 around that period on this because I guess the issue of
8 negative payback had not been considered in detail at
9 the time of the original contract and there was debate
10 and discussion at that time and this method of accrual
11 and taking it out of the future payback was agreed.

12 [12:11 p.m.]

13 MS. McCLENAGHAN: Q. Now is it fair to
14 say that from this table Pickering Units 1 and 2 have
15 not been cost effective relative to a comparable
16 fossil-fired station since 1984?

17 MR. DALY: A. Well, certainly during
18 those four years of retubing they weren't, they were
19 running at very low capacity factors with high cost,
20 however I think to get, to get the true picture over
21 the longer period you have to go back -- we haven't
22 provided the figures before 1980, and they would
23 generally all be positive. So certainly there was this
24 period where it was significantly negative, but many
25 years for which it was also significantly positive.

1 Q. Now when we look at Hydro's recent
2 OEB filing at page 80, and we see the forecast
3 corresponding to the forecasts in 9.2.44 under table
4 5.8; is that right?

5 A. Right.

6 Q. And if you compare that to the
7 figures on page 78, 1991 showed a negative payback of
8 4.8 and 1991 actually was negative 6; is that right?

9 A. Correct.

10 Q. Those are in millions of dollars?

11 A. Yes.

12 Q. And for 1992 the projection is
13 somewhat reduced in the current forecast from 9.6 to 8?

14 A. Correct.

15 Q. So it would seem that the forecast
16 last May in answering Interrogatory 9.2.44 was too
17 optimistic about the competitiveness of Pickering;
18 would that be fair?

19 A. For '92?

20 Q. Pickering 1 and 2?

21 A. For the years you quoted there, '91
22 and '92, yes, slightly.

23 Q. It would seem as well for 1993 since
24 the answer in May was \$12 million, and the most recent
25 forecast now is \$7 million?

1 A. Well certainly the forecast has
2 changed in a downward direction, yes.

3 Q. And would you agree that these
4 numbers indicate that retubing Pickering 1 and 2 so far
5 hasn't been worth while; is that right?

6 A. No, I wouldn't agree with that. I
7 think retubing Pickering 1 and 2 has allowed those
8 units to return to service at a reasonably healthy 75
9 per cent power, and I think, certainly from our point
10 of view, retubing of those units was definitely worth,
11 worth doing.

12 Q. But even so, isn't it the case that
13 you are not generating an operating profit yet; is that
14 right?

15 A. Are you meaning in terms of the, of
16 the payback?

17 Q. Yes. Since retubing, yes.

18 A. Well, as this table 5.8 indicates a
19 payment, the payback does move into the positive range
20 in '92, albeit not at the higher values of some of the
21 previous years. I'm afraid I don't have a projection
22 beyond '93. I think to fully answer your question you
23 would have to look at the forecast payback for the
24 years beyond '93, and those would be dependent on the
25 costs and the electricity production from Pickering,

1 and certainly Pickering will still be in the retubing
2 phase until early '93 with Pickering 4. So all the
3 figures you are seeing there are influenced by
4 Pickering -- sorry. Strike that comment. It's
5 irrelevant. The payback only affects Pickering 1 and
6 2.

7 Q. Right.

8 A. So we would have to look at the
9 forecast performance from those units post '93, and the
10 operating costs. I don't have the trend beyond '93.

11 Q. The size of the negative payback
12 account is supposed to decrease to zero by the year
13 2003 when the agreement concludes; is that right? Page
14 78 of the Interrogatory response indicates payback
15 until the year 2003?

16 A. That's the term of the contract as I
17 understand it.

18 Q. All right. It appears from this
19 response that the negative payback account is actually
20 increased from \$258 million to \$296 million as of
21 December 31st, 1988; is that right?

22 THE CHAIRMAN: Where do you get those
23 figures?

24 MS. MCCLENAGHAN: \$258 million is
25 mentioned in the first paragraph of page 78.

1 MR. DALY: A. Well, 258 was the original
2 contributions to the capital cost and the accumulated
3 negative payback including interest, as you say, is 296
4 million.

5 Q. So, in effect, if you were to compare
6 that to a mortgage holder the mortgage holder is owed
7 more money at the end of this period than it owed
8 originally; is that right?

9 A. Well, the 296 figure is at the end of
10 December '88. You would have to add on both the
11 positives and negatives between '88 and '94. That
12 figure is probably not going to change too much.

13 THE CHAIRMAN: At the end of '88 years
14 -- what years were taken into account to arrive at that
15 negative figure?

16 THE DALY: I take that to be all years in
17 which they had negative payback.

18 So if it's as of December the end of '88,
19 my assumption is that it would include the '84 to '87
20 figures plus the associated interest.

21 THE CHAIRMAN: So it doesn't reflect the
22 payments that were made in earlier years?

23 MR. DALY: I can't answer that, I'm
24 sorry.

25 MS. McCLENAGHAN: Q. Now, in terms of

1 the comment you were just making about adding the
2 positives and negatives since 1988, it would seem that
3 there would be a net negative impact since then, so
4 that we would expect that the number that currently
5 exists is even a little bit higher than \$296 million;
6 is that right?

7 MR. DALY: A. Taking interest into
8 account?

9 Q. Including interest, yes.

10 A. Ms. McClenaghan, I haven't done this
11 calculation. I think you are probably right. I would
12 have to check the calculation, also the point that the
13 Chairman raised.

14 Q. All right. And what you will be
15 looking at is net negative in 1990 of \$50 million and
16 in 1991 of \$4.8 million, which now you know is net
17 negative \$6 million in fact, against a positive of 11
18 plus one for the years 1988 and 1989; is that right?

19 A. Correct. If you want me to do it
20 until the end of 1991.

21 Q. All right. So the difference to the
22 \$296 million would be 21 minus 12; right?

23 A. Subject to check, yes.

24 MR. PENN: A. I am not quite sure that I
25 am following all this, Mr. Chairman, but the actual

1 payback to the province and to the federal government
2 through AECL started of course in 1971, and obviously
3 in that decade to 1980 was pretty considerable, at
4 least of the order of \$220 million, and continued right
5 through to 1983.

6 Now, the paragraph at the bottom of this
7 page marked 78 is referring to the cumulative negative
8 payback just during the years 1983 through 1988,
9 including interest that would have been accrued. So
10 that if there is - and I may be a little out of line
11 here - if there is an inference that that payback has
12 been other than positive through the life of Pickering,
13 I think that's quite wrong.

14 DR. CONNELL: I assume that the 258 cited
15 in the first paragraph is expressed in 1971 dollars; is
16 that correct?

17 MR. PENN: I would assume so, Dr.
18 Connell, yes.

19 The actual cost of the Pickering "A", all
20 four units, was about \$800 million in dollars of the
21 year, and this of course was only a sharing of risk on
22 the first two units built in the province, and the
23 agreement was that the risk would be shared three ways.

24 THE CHAIRMAN: Just as a housekeeping
25 matter, am I right in assuming that pages 44 and page

1 80 in your exhibit come from the same document,
2 although they have different facing pages, and that
3 document is Exhibit 571?

4 MS. McCLENAGHAN: Yes, that's right, Mr.
5 Chairman.

6 THE CHAIRMAN: Thank you.

7 MS. McCLENAGHAN: Mr. Chairman, I would
8 like to turn to the exhibit package titled Materials
9 Relating to Early Shutdown of Nuclear Stations, and we
10 will need an exhibit number for that exhibit.

11 THE CHAIRMAN: What tab is that behind,
12 please? You don't have tabs.

13 MS. McCLENAGHAN: I'm sorry.

14 THE CHAIRMAN: All right I have got it.
15 It is behind tab F in our the material.

16 What is the next exhibit number?

17 THE REGISTRAR: 617.

18 THE CHAIRMAN: Thank you.

19 ---EXHIBIT NO. 617: Package entitled: Materials
20 Relating to Early Shutdown of Nuclear
21 Stations.

22 MS. McCLENAGHAN: Q. First of all, Mr.
23 Penn, I wonder if I could refer you to Volume 124 of
24 your evidence at page 21754?

25 MR. PENN: A. Ms. McClenaghan, would you
mind repeating the page number?

1 Q. Sure. 21754.

2 And, in particular, your evidence at that
3 point was that in the United States there are plants
4 that are more than 30 years old in the second paragraph
5 of the page, and I want to refer you to page 1 of this
6 exhibit package.

7 A. I'm sorry, I haven't found the
8 sentence yet you are referring to on 21754.

9 Where is the number?

10 Q. It is at line 18.

11 A. Thank you.

12 Q. Sorry. And page one of this exhibit
13 package contains a list of United States, the 22 oldest
14 commercial atomic reactors and when they went into
15 operation under 40-year licenses according to U.S.
16 Council for Energy Awareness, a local industry group.

17 Do you agree with that list as being in
18 accord with your knowledge of the plants in the United
19 States?

20 A. Well, I'm afraid I don't carry in my
21 head the age of every plant in the United States, but I
22 will take it subject to check that this is right.

23 Q. All right. And from that list it
24 appears that the oldest plant is Yankee Rowe,
25 Massachusetts.

1 A. Yes.

2 Q. Licenced in July 1961?

3 A. That's right.

4 Q. And that's the only plant on the list
5 that would be 30 years old or older; is that fair?

6 A. It would be 31 years old, and the
7 next oldest according to this list would be 27 years
8 old.

9 Q. Were you thinking of any other plants
10 when you mentioned that there are plants that are more
11 than 30 years old?

12 A. I think when I made the statement on
13 page 21754 from Volume 124 of the transactions that we
14 were talking at that time about life extension, I
15 believe, and I was commenting that plants in the United
16 States were getting to the point where they were
17 considering life extension.

18 I would have to agree that my comment
19 there, that are more than 30 years old only clearly
20 refers to one in the United States.

21 Q. And on line 22 of the following page,
22 21755, you were speaking about an application for a
23 life extension?

24 A. Yes, I was.

25 Q. And you referred to a plant by the

1 name of Monticello from Minneapolis.

2 A. Yes.

3 Q. And it would appear from page 1 of
4 this exhibit package that Monticello was licenced in
5 1971 and so would only be 21 years old; is that right?

6 A. It would be coming up to 22 years,
7 yes.

8 Q. Now, I understand that until recently
9 Yankee Rowe was considered one of the success stories
10 of the U.S. Nuclear Power program because it had 30
11 years of good operation? Was that your understanding
12 or is that your understanding?

13 A. Well, I'm afraid I don't know the
14 performance history of Yankee Rowe. I know more about
15 it's recent situation.

16 Q. And I understand that last year the
17 owners decided to shut down the reactor; is that right?

18 A. Well, I think you are right. I
19 recall that the owners of the plant recognized that
20 they had cracking or the potential for cracking, I
21 think the latter in the reactor vessel, and the matter
22 was subject to review with the regulatory authorities.
23 But whether it's been shut down permanently I don't
24 know.

25 Q. We understand that the owners had

1 planned originally to operate the plant at Yankee Rowe
2 for 40 years; is that your understanding?

3 [12:30 p.m.]

4 A. I'm sorry, I don't know what their
5 plans were.

6 Q. Would that be your understanding if
7 they were given a 40-year licence as indicated on page
8 1 of the material?

9 A. Well, I am a bit surprised that the
10 statement on the second line here of a 40-year licence.
11 I wasn't aware that all plants in United States had a
12 40-year licence. I don't know if Mr. King could help
13 me.

14 MR. KING: A. My understanding of the
15 situation is that the Atomic Energy Control Act or
16 whatever the proper name of the Act is in the United
17 States, there is a limit of 40 years licence in it and
18 that plants normally get licence for 40 years. I am
19 not saying that's absolutely the case, but that's just
20 my general understanding.

21 Q. So that would be consistent with the
22 indication on page 1 of the material?

23 A. Yes.

24 Q. Now, I understand that the problem
25 which caused the final decision of the owners to shut

1 down the plant was based on the fact that they would
2 have had to investigate, as you were indicating, the
3 tendency of the pressure vessel to crack, and that that
4 would have cost \$23 million, and because of uncertain
5 results they decided they couldn't take that decision.

6 Is that your understanding?

7 MR. PENN: A. Well, I assume that you
8 are looking at page 3 now. I personally don't have
9 detailed knowledge except that I am aware that certain
10 interest groups in particular questioned the
11 metallurgical properties of the steel pressure vessel,
12 and I believe the utility who owns Yankee Rowe were
13 considering processes to anneal the pressure vessel,
14 but I have no knowledge of what their economic analysis
15 was that led, I presume, to them deciding not to do it.

16 Q. Would you agree that there are Hydro
17 units, for example Bruce 2, where the cost of repairing
18 steam generators and pressure tubes is 20 to 40 times
19 greater than the \$23 million figure that we indicated
20 was concerning Yankee Rowe?

21 A. Well, I have no idea whether the \$23
22 million -- \$23 million is a surprisingly small amount
23 of money to me to close down a plant, if that's all
24 that's necessary to repair it. And when it's got still
25 nine years life, I think there must have been other

1 reasons for the decision.

2 Q. Could those reasons have been
3 uncertainty about the results of the \$23 million
4 investment?

5 MR. B. CAMPBELL: Mr. Chairman, I'm
6 sorry, where is this \$23 million coming from?

7 THE CHAIRMAN: Well, it was suggested to
8 the witness, the \$23 million, he doesn't know anything
9 about that. All he said is, to him, \$23 million would
10 not be an amount that would drive them to abandon the
11 operation. I think that's as far as we got with this
12 line.

13 MS. MCCLENAGHAN: Q. Assuming for a
14 moment that it was the cost and the uncertain results
15 that did cause that decision, could a similar problem
16 arise in Ontario where aging makes a plant not worth
17 further investment before its scheduled service life is
18 over?

19 MR. PENN: A. Well, hypothetically, I am
20 sure there could be a circumstance where it would be
21 decided that it is not economic to continue operation.
22 And when we discussed Douglas Point, that was clearly
23 the reason in that case why Douglas Point was closed,
24 because the repair and its eventual capacity factor
25 just was such that it wouldn't be economic power,

1 compared with what else was on the system.

2 Now I have mentioned that, I don't know
3 the details of what is on Yankee Atomic Electric
4 Company's power system, but their decision undoubtedly
5 was related in part to generation on their system as
6 opposed to continued generation on this plant. But I
7 am speculating now, I don't know the details of that
8 plant.

9 I don't see, by the way, even in the
10 newspaper article, this \$20 or \$40 million you
11 mentioned either, I don't know where it comes from.

12 Q. The next plant I would like to look
13 at is the San Onofre one, and there are materials
14 relating to that shutdown beginning at page 4 and going
15 to 25 of the exhibit package. And that was a situation
16 where San Onofre 1 in Southern California was shut down
17 early; is that right? Are you familiar with that at
18 all?

19 A. I am not very familiar with San
20 Onofre, apart from reading the Nucleonics Week that you
21 provided, and noting that the matter was also subject
22 to a pressure group as well called The Division of
23 Ratepayer Advocates.

24 Q. A pressure group who were concerned
25 about the rates they were paying; is that fair?

1 A. Well, at least one person in it was.

2 Q. Are you familiar with the fact that
3 the Division of Ratepayer Advocates is part of the
4 regulatory body in California?

5 A. No, I wasn't aware of that.

6 Q. It seems to be indicated in the first
7 paragraph of the second column under the title Utility
8 Owners Arm of State PUC Strike Deal to Close San Onofre
9 1?

10 A. Which page of your exhibit?

11 Q. Page 4 of the exhibit under the title
12 Utility Owners, and so on, in the first paragraph.

13 THE CHAIRMAN: Well, if all he knows
14 about this is what he has read in this exhibit, I don't
15 know how much help you can get from him about it.

16 The exhibit, such as it as, speaks for
17 itself.

18 MS. McCLENAGHAN: Q. Now would you
19 agree, Mr. Penn, that Nucleonics Week is a respected
20 trade journal in the nuclear industry?

21 MR. PENN: A. Yes, I believe it is.

22 MR. B. CAMPBELL: Mr. Chairman, I am not
23 sure that that really very much helps with your point.
24 I don't see the point. The witness has clearly said
25 that he is not familiar with the details, to have him

1 simply regurgitate material that is put in front of him
2 by the cross-examiner, presumably most people in this
3 room can read.

4 THE CHAIRMAN: Of course this isn't
5 evidence anyway, so it doesn't really matter.

6 MR. B. CAMPBELL: So I think it's a
7 waste of time to ask him any further questions about
8 San Onofre.

9 MS. McCLENAGHAN: Mr. Chairman, my
10 question is, first of all, whether the witness is
11 familiar with these shutdown situations.

12 THE CHAIRMAN: He says he wasn't except
13 what he has read in here, so I don't think it's of any
14 help to you. At least that is what I thought he said.

15 MR. PENN: Yes, I don't have detailed
16 familiarity with San Onofre, other than general
17 reading. I just don't know.

18 MS. McCLENAGHAN: So our concern is
19 whether or not Ontario Hydro is paying attention to
20 situations around the world where other nuclear
21 generating stations are shut down early and what those
22 reasons are, which might be relevant to the situation
23 in Ontario, and I think that's --

24 THE CHAIRMAN: You can ask him that
25 question, if you like.

1 MS. McCLENAGHAN: That's why we are
2 asking, first of all --

3 THE CHAIRMAN: Ask him the question then.

4 MS. McCLENAGHAN: Q. Suppose we do it
5 this way, Mr. Penn, since you indicated that you were
6 not directly familiar with the situation, if we can
7 consider our understanding of the situation as a
8 hypothetical and then ask you the questions on that
9 basis.

10 The understanding we have is that the
11 plant owners were faced with a situation where they
12 were asking the rate regulator to recover costs for
13 some expensive repairs to their 24-year old reactor,
14 and they claimed that the unit would produce at 70 per
15 cent capacity factor after the repairs. The regulator
16 said if it didn't achieve 55 per cent capacity factor,
17 the utility's shareholders would have to cover the
18 costs. Our understanding is, as a result of this
19 demand the utility decided it couldn't run the risk of
20 further investment and decided to close the plant.

21 Now, it would seem, first of all, \$125
22 million investment, if we hypothetically assume that
23 was what it was, doesn't sound like very much money for
24 Ontario Hydro for repair bills; is that fair?

25 MR. PENN: A. Well, I don't know how big

1 a utility -- this is Southern California is it, the
2 utility?

3 Q. Yes.

4 A. I am almost certain that it would be
5 a privately-owned utility and would have shareholders.
6 I don't know what its financial position is.

7 The only thing I know about the San
8 Onofre plant is that it historically didn't operate
9 very well. Typically, it had a lifetime capacity
10 factor of about 52 per cent. It had a recent capacity
11 factor that was less than 40 per cent, and I am sure
12 that that sort of thing was taken into account.

13 I have no idea what the general condition
14 of the plant was.

15 Q. Now, could a situation like the San
16 Onofre 1 shutdown, could a decision like that happen in
17 Ontario where because of the cost of repairs and the
18 unwillingness of the ratepayers to bear those costs, a
19 shutdown would result?

20 MR. B. CAMPBELL: Well, Mr. Chairman, we
21 had this question about fifteen minutes ago and he said
22 hypothetically that circumstance could happen.

23 Again, it's not that I argue that this
24 particular question is irrelevant, it is just that we
25 are using a lot of public time and money for exploring

1 matters where the witness is either basically reading
2 material that has been put before him, or he has
3 already answered this question. There has got to be
4 some concept of efficiency here.

5 MS. McCLENAGHAN: Q. Let me rephrase the
6 question, because it is a different question.

7 The first question related to whether
8 Ontario Hydro might make a decision just based on the
9 investment or worth of a particular repair. This
10 question concerns whether or not the cost of repair or
11 investment versus its worth could cause a shutdown
12 decision because of ratepayers refusing to bear those
13 costs.

14 THE CHAIRMAN: I am not quite sure what
15 you mean by ratepayers refusing to bear the cost. What
16 do you mean by that?

17 MS. McCLENAGHAN: That's apparently what
18 happened in the San Onofre.

19 THE CHAIRMAN: I don't care what happened
20 in San Onofre or California. I want to know what you
21 mean by ratepayers refusing to bear the cost.

22 MS. McCLENAGHAN: Is it possible in
23 Ontario that can help.

24 THE CHAIRMAN: I don't know, but I don't
25 think Mr. Penn does either. I don't think it's a

1 question he should have to answer.

2 I think you better go on to another line
3 of questioning.

4 MS. McCLENAGHAN: Q. The next shutdown I
5 would like to ask you if you are familiar with, Mr.
6 Penn is Rancho Seco in Sacramento. Are you or anyone
7 else on the panel familiar with that shutdown?

8 The materials refer to it at pages 26 to
9 32.

10 MR. DALY: A. Like Mr. Penn, I am
11 familiar with it from the materials you have provided.

12 THE CHAIRMAN: I think you can ask any
13 question you like relating to what we are talking about
14 here, but I don't think it's much help to me at least
15 to go over what has happened in other jurisdictions
16 about things that have nothing to do with Ontario.

17 MS. McCLENAGHAN: Well, that's the line
18 of this questioning, Mr. Chairman, is to inquire as to
19 whether these things do anything to do with Ontario or
20 not.

21 THE CHAIRMAN: You had a question a few
22 minutes ago, which I thought was quite a good one but
23 you haven't asked it yet, and that is, to the extent to
24 which Hydro monitors what is going on in other parts of
25 the world about these things. It's a perfectly

1 legitimate issue and I think that's a good issue to
2 address. But I don't think talking about ratepayer
3 opposition, that doesn't mean very much to me. They
4 don't seem to know what it is either.

5 MS. McCLENAGHAN: Q. Based on that, Mr.
6 Chairman, I will ask Mr. Penn or anyone else on that
7 panel that question, which is whether Ontario Hydro
8 does monitor shutdowns in other parts of the world and
9 the reasons for those shutdowns.

10 MR. PENN: A. Well, that's a slightly
11 different question than the Chairman mentioned.

12 Ontario Hydro has agreements, technical
13 exchange agreements with most of the major utilities in
14 the world, including EDF, Tokyo Electric, EPDC, is an
15 associated member with EPRI, and has close relationship
16 with Duke Power in the United States and many other
17 utilities. We meet reasonably frequency, because of
18 these technical exchanges, to exchange information on
19 both operation and design including decommissioning and
20 used fuel management and the rest.

21 Where an issue is relevant to the CANDU
22 system, we obviously design agendas to bring that
23 information out.

24 Now, I am only one person that's involved
25 in these exchange agreements, but we had no need,

1 because the systems are so different, to contact
2 Southern California or wherever, to talk about Rancho
3 Seco and San Onofre.

4 MS. PATTERSON: I thought that the reason
5 that these questions were being asked is that you said,
6 Mr. Penn, that they are plants in the U.S. that are
7 more 30 years, so we can gain some impression of the
8 kind of regulatory regime that's being undergone there,
9 and also use that, to some extent, to decide whether we
10 can get to a 40-year life here.

11 I think what Ms. McClenaghan has
12 established is that there really isn't much experience
13 with plants over 30 years in the U.S.

14 MR. PENN: That's right quite right, Ms.
15 Patterson. I would agree that there are very few
16 plants in the United States, there appeared to be one
17 over 30 and a few others that are approaching it.

18 I think when Mr. Heintzman was
19 cross-examining me, he was talking about the potential
20 advantages of life extension of nuclear power in
21 relationship to life extension of fossil generation,
22 and I was answering questions on what the process is in
23 United States.

24 One of the points that came out of that
25 discussion was that in the United States plants are

1 licenced for between 30 and 40 years, whereas in
2 Ontario and in Canada our licences are reviewed and
3 renewed between one and three years. The relevance of
4 that was that our plants, because their licences are
5 reviewed very frequently, we expect the condition of
6 our plants to be such that they will certainly last up
7 to 40 years and potentially there would be an
8 opportunity to extend their lives, but we didn't have
9 enough knowledge at the moment to take that step.

10 So I think that was the context, if
11 that's helpful.

12 MR. KING: If I could just add a comment
13 about the regulatory situation in the States.

14 As Mr. Penn has just referred to, the
15 40-year life, the licence duration that they get, and
16 then if they want to pursue a life extension they have
17 to go through a very long involved regulatory process
18 with hearings and just the whole system in the United
19 States requires them to start any life extension
20 process before year 30. As soon as they start
21 approaching year 30 they have to start getting into
22 this mode if they want to go through the life extension
23 effort.

24 And also with respect to my previous
25 comments on the 40-year lifetime, I think Ms.

1 McClenaghan, you were suggesting that because they have
2 a 40-year life, it was the intention to operate for 40
3 years, and I just wanted to make it clear that that
4 was not information that I was giving.

5 [12:50 p.m.]

6 Everybody gets a 40-year license and in
7 particular the Yankee Rowe plant, which is a very small
8 plant, it is a 180, 190, something like that, megawatt
9 plant. What the intention of running that plant was,
10 the duration that they intended on running it back in
11 the 1950s when it was being designed, I have no
12 knowledge on how long they intended to run it.

13 MS. McCLENAGHAN: Q. Now, Mr. Penn, I
14 take it that you would agree from your knowledge that
15 you do have, that many of the older plants in the
16 United States and elsewhere are being shut down for
17 various reasons, be they technical or economic; would
18 you agree with that?

19 MR. PENN: A. Well, I don't know how
20 many there are, but I am aware that in Britain, for
21 example, early Magnox gas cooled reactors have been
22 shut down. In France, very early pressure tube --
23 actually heavy water based reactors have been shut
24 down, and there has been a small plant in Japan shut
25 down, and now we are seeing some plants in the United

1 States. And, of course, here at home we have shut down
2 NPD and Douglas Point.

3 Q. Now in terms of the exchanges that
4 you indicated that you participate in, it sounded as
5 though you were talking about technical exchanges; is
6 that right?

7 A. Yes.

8 Q. And do you inquire about or seek
9 information about other reasons for plant shutdowns
10 other than technical reasons, such as economic reasons?

11 A. I haven't had occasion to, no. I
12 can't speak for the whole of Hydro in this matter.

13 Q. But you are not aware or no one on
14 the panel is aware of any information that Ontario
15 Hydro obtains or has about economic characteristics of
16 early shutdowns?

17 A. No. I think we would be much more
18 interested in the process of decommissioning the plant
19 than the reason why the particular utility or owner was
20 deciding to shut it down. That would be something of
21 value to us.

22 Q. I would like to deal with the Douglas
23 Point nuclear power station which you referred to.

24 THE CHAIRMAN: If you are going to turn
25 to that,

1 perhaps, we'll adjourn--

2 MS. McCLENAGHAN: Sure.

3 THE CHAIRMAN: --and continue at 2:30.

4 THE REGISTRAR: This hearing will adjourn
5 until 2:30.

6 ---Luncheon recess at 12:54 p.m.

7 ---On resuming at 2:37 p.m.

8 THE REGISTRAR: This hearing is again in
9 session. Please be seated.

10 THE CHAIRMAN: Ms. McClenaghan.

11 MS. McCLENAGHAN: Thank you, Mr.
12 Chairman.

13 Q. Mr. Penn, I wonder if I could first
14 refer you to evidence given earlier in this panel, an
15 excerpt of which is found at tab A of the materials in
16 Exhibit 608 at page 118, and that's from Volume 127.

17 THE CHAIRMAN: Page again, please?

18 MS. PATTERSON: 118.

19 MS. McCLENAGHAN: It's page 118, Mr.
20 Chairman.

21 THE CHAIRMAN: Thank you. Did you say
22 tab A? I'm sorry. I'm getting mixed up here.

23 MS. McCLENAGHAN: Q. It's page 118 of
24 Exhibit 608, and Mr. Hamer was cross-examining you, Mr.
25 Penn. And you indicated the question was:

1 Mr. Penn, from some of your earlier
2 evidence, I understand you to have
3 considerable exposure to what is going on
4 in the world outside Canada in relation
5 to nuclear energy; is that fair?
6 You visit Georges Moynet?

7 And you said:

8 I think that's reasonably fair, yes.
9 And I am wondering if you wish to qualify your answer
10 to that question in terms of whether you would say that
11 you have considerable exposure to what is going on in
12 the world outside Canada in relation to nuclear energy?

13 MR. PENN: A. Well, over the last 10
14 years, for example, through my responsibilities, I have
15 been in contact with utilities in Japan, visited there,
16 France, Britain, Sweden, United States.

17 Q. And so, is it your evidence that you
18 are fairly familiar with what is going on in those
19 countries in relation to nuclear energy?

20 A. I have an understanding from the
21 point of view of design and construction issues, and
22 future planning with respect to my responsibilities at
23 Hydro.

24 Q. Would you say that you have an
25 understanding of the issues concerning shut down of

1 nuclear reactors in those countries?

2 A. Well, as I said this morning, the
3 only interest I would have in the shut down of those
4 facilities is with regard to subsequent decommissioning
5 plans for those plants from a general knowledge point
6 of view.

7 Q. Is there anyone at Ontario Hydro
8 whose job it is to know about the situation in these
9 countries and other countries pertaining to shutdowns
10 of nuclear power stations?

11 A. Well, apart from the subject I have
12 just mentioned, I don't think Hydro has, while it
13 always has interest, I don't think it has knowledge to
14 gain from whether a plant is shutting down.

15 Our interest is keeping plants running
16 and this morning I talked about who we had technical
17 agreements with, and one that I neglected to mention
18 was INPO, for example, which is an international group
19 which is purposely seeking ways to improve performance
20 of operating plant and to share information on it.

21 So those are the sorts of subjects. We
22 have interest in keeping running what we have got to
23 the best of our ability and at the lowest cost and we
24 have interest in planning for the future.

25 Q. The next particular shut down I would

1 like to look at is the shut down late last year of
2 Hunterston "A" in Scotland and our materials at pages
3 33 to 39 in Exhibit 617 contain those materials. And I
4 believe I should direct my questions to either Mr. Penn
5 or Mr. Daly.

6 Mr. Penn, I understand you were a reactor
7 designer in the -- pages 33 to --

8 A. I am still searching for 617. I'm
9 sorry. What does it look like?

10 THE CHAIRMAN: It is behind tab F.

11 MR. PENN: I'm sorry Ms. McClenaghan,
12 which page were we on?

13 MS. MCCLENAGHAN: Q. 33 to 39 contain
14 the materials dealing with Hunterston "A".

15 MR. PENN: A. Thank you. The answer is
16 yes.

17 Q. Yes, you were a reactor designer in
18 the U.K. in the late 50s and early 60s?

19 A. I was a reactor physicist, yes.

20 Q. And Mr. Daly, I understand you worked
21 at Hinkley Point?

22 MR. DALY: A. That's correct.

23 Q. And I understand that Hunterston "A"
24 was opened in 1964 and operated for 26 years just short
25 of it's expected 30-year life; is that right?

1 A. I'm not sure of the exact dates but
2 it certainly was approximately that period, yes.

3 MR. PENN: A. I remember it being
4 designed but I came to Canada before then.

5 Q. You came to Canada before it opened?

6 A. Yes.

7 Q. And I understand that Hunterston "A"
8 operated at a high capacity factor throughout it's
9 life; is that right?

10 A. It operated, I believe, at about 70
11 per cent.

12 Q. And according to the South Scotland
13 Electricity Board on page 37 of the materials,
14 Hunterston "A" received a favourable long-term safety
15 review by the Nuclear Installations Inspectorate in
16 1989?

17 A. You are referring to the last
18 paragraph of page 37?

19 Q. That's right.

20 A. That's what it says.

21 Q. And is that your understanding?

22 A. I'm afraid I have not got detailed
23 knowledge of what happened in Britain in 1989.

24 Q. But do you have any knowledge of any
25 safety review which indicated that they didn't have a

1 favourable safety situation at Hunterston "A"?

2 A. No I don't have any knowledge of
3 that.

4 Q. Page 33, Mr. Penn, is a cover page of
5 a report from the energy committee in the U.K. entitled
6 The Cost Of Nuclear Power, and this is Volume 2,
7 Minutes of Evidence dated June 7th, 1990.

8 Are you familiar with this report?

9 A. I have an appreciation of this
10 hearing. Yes.

11 I might add that the hearing started in
12 the fall of 1987 and was completed in June of 1990. A
13 two-and-a-half year Select Committee Review on Energy
14 in the British House of Commons.

15 Q. Now, page 35 and following is stated
16 to be a memorandum submitted by the south of Scotland
17 Electricity Board which would have been the utility
18 which operated Hunterston "A"; is that right?

19 A. Did you say page 35?

20 Q. Yes. Page 35 under the title in the
21 middle of the page, Supplementary Memorandum submitted
22 by the South of Scotland Electricity Board.

23 A. Yes, South of Scotland Electricity
24 Board were the owners of Hunterston "A".

25 Q. And then I note at the bottom of page

1 36 in this memorandum and then over to the top of page
2 37, the Electricity Board stated that, the load demands
3 in Scotland -- this is the very bottom of the page
4 after a question:

5 A summary of the case which lead to
6 the decision to close Hunterston "A" on economic
7 grounds.

8 It says:

9 The load demands in Scotland together
10 with the reinforced capacity of the
11 interconnector to England and Wales
12 which it is expected can be provided by
13 1983, '84, can be fully serviced by
14 existing capacity in Scotland without the
15 need of the 300 megawatts of Hunterston
16 "A". Thus in principle it has only be
17 economic to continue operation at
18 Hunterston "A" while the total operating
19 costs, i.e. fuel plus salaries and
20 maintenance, were less than the costs of
21 increased output from other stations.

22 For many years this has indeed been
23 the case but the rapidly increasing costs
24 of Magnox reprocessing combined with
25 steady or falling fossil fuel costs

1 altered the economics in the late 1980s
2 leading to the decision to close the
3 station.

4 Is that your understanding of what happened at
5 Hunterston "A" as far as the decision to close that
6 station?

7 A. Yes. The interconnects with England
8 provided south of Scotland with reliable power and one
9 of the key things in that sentence is the cost of
10 reprocessing Magnox fuel, and these costs having to be
11 shared by utilities in Britain. Of course a subject
12 that our plants are not liable for.

13 Mr. Chairman, just in case you are not
14 familiar, the reason that these gas cooled reactors in
15 Britain are called Magnox is because the cladding on
16 the fuel is of a magnesium alloy and the coolant is
17 carbon dioxide and the moderator is graphite blocks.

18 Q. I would like to turn now to the
19 situation for Douglas Point nuclear power station and
20 the materials in this exhibit begin at page 40.

21 Mr. Daly, I understand you were an
22 assistant technical engineer at Douglas Point; is that
23 right?

24 MR. DALY: A. That's correct for a short
25 time in the early 70s.

1 Q. And, Mr. Penn, were you involved with
2 Douglas Point as well in your employment with General
3 Electric?

4 MR. PENN: A. Not really, no. Apart
5 from the fuel.

6 Q. Now, Mr. Daly, I wonder if you can
7 confirm, my understanding was that Douglas Point was
8 owned by AECL and it's power was purchased by Ontario
9 Hydro at the cost of competing go coal-fired power. Is
10 that your understanding?

11 MR. DALY: A. Certainly we operated it.
12 I can't confirm the exact costing arrangements but it
13 was similar I think. I can agree in general terms.

14 Q. All right. So would it be fair to
15 describe Douglas Point as a nuclear non-utility
16 generating plant?

17 A. I guess I wouldn't use that term.

18 It was our second prototype. The first
19 plant we operated was the NPD plant which was a
20 demonstrator plant. Douglas Point we regarded as more
21 of a larger prototype. I think the expression
22 non-utility generator has come into more common usage
23 here within the last few years, but we certainly didn't
24 describe it as that at the time.

25 Q. No, but if you used the phrase the

1 way you use it today, would you describe it as a
2 non-utility generator?

3 A. Well, we operated the plant. I tend
4 to think of many of the non-utility generators as being
5 operated by the company that owns the plant. So I
6 think there were some special circumstances there where
7 we were, Ontario Hydro was actually operating the
8 plant. And I don't imagine that will apply for all of
9 the non-utility generators.

10 I think there are some differences.

11 Q. Now I understand that Douglas Point
12 was originally supposed to operate for 30 years; is
13 that right?

14 A. That's my understanding, yes.

15 Q. And it was shut down after only 17
16 years of service? Is that right?

17 A. That's correct.

18 Q. And I think, as was mentioned earlier
19 today, perhaps by Mr. Penn, I understand that an
20 Ontario Hydro study in 1985 found that purchase of the
21 plant would not be economic even if the price was only
22 \$1; is that right?

23 A. That's essentially right. Had AECL
24 decided to continue operating the plant it would appear
25 at that time as if pressure tube replacement would be

1 necessary. During that period of time we had just had
2 the pressure tube failure on Pickering and that lead to
3 a re-evaluation of pressure tube condition and
4 economics and so on.

5 So that was one factor also. The other
6 important factor was there was a lot of cheaper power
7 available on-site from Bruce "A" and Bruce "B", so in
8 terms of power from that region, there was plenty of
9 power available from Bruce "A" and Bruce "B" and the
10 economics, given it's situation in that part of Hydro's
11 system, it's situation became rapidly uneconomic.

12 [2:50 p.m.]

13 Q. And in addition to the pressure tube
14 problems, another problem that it had which contributed
15 to the decision was steam generator problems; is that
16 right?

17 A. There were some steam generator
18 problems in the earlier years, but I don't recall that
19 being a major factor in the shutdown decision.

20 My recollection is that it was primarily
21 the pressure tubes and the fact that we had the large
22 amounts of cheaper power available on-site.

23 MR. PENN: A. I might add that the \$1 of
24 course would have been necessary to legalize change of
25 ownership, but that's the only significance the dollar

1 had.

2 But, of course, and I don't know the
3 details, but there were subsequent responsibilities
4 that Hydro would have assumed with gaining that
5 ownership that came into the discussion.

6 Q. Responsibilities like
7 decommissioning?

8 A. I can't confirm that, but that's one
9 possibility, yes.

10 Q. Now, I understand that Ontario Hydro
11 changed the depreciation period on its nuclear units in
12 1983 from 30 years to 40 years; is that right?

13 A. That's correct.

14 Q. I would refer you to page 46 and 47
15 of this exhibit package where there is an interrogatory
16 response from 1984, from a 1985 Ontario Energy Board
17 rate hearing. Energy Probe asked Ontario Hydro in
18 subparagraph G, to justify assuming a 40-year service
19 life for the reactors given the Douglas Point shutdown,
20 do you see that?

21 THE CHAIRMAN: What paragraph was it?

22 MS. McCLENAGHAN: Paragraph G at the
23 bottom of page 46 of the material.

24 THE CHAIRMAN: I see it. All right.

25 MR. PENN: You are referring to in

1 relationship to paragraph F, are you, as well?

2 MS. McCLENAGHAN: Q. It's mainly G I am
3 looking at at the moment.

4 MR. PENN: A. Well, I don't see a
5 relationship between the actual lifetime of Douglas
6 Point and the forecast lifetime of Hydro's power
7 stations. There is no connection.

8 Q. And that was referred to in the
9 response to the interrogatory on page 47 under the
10 response to paragraph G, there is an indication that
11 the lifetime and life expectancy referred to in the
12 interrogatory are not comparable, and it goes on to
13 talk about Douglas Point, a prototype generating
14 station that is owned by AECL has been closed by its
15 owner because AECL believes continued operation is not
16 economic.

17 And then it says:

18 The life expectancy, presumed to mean
19 depreciation period, of Ontario Hydro-
20 owned commercial nuclear generating
21 stations is set by the Depreciation
22 Review Committee.

23 It says:

24 The judgment of this committee is
25 unaffected by AECL's decision to close

1 Douglas Point. Pickering "A" and Bruce
2 "A" have consistently demonstrated that
3 they produce electricity more
4 economically than comparable fossil-fired
5 stations. In 1983 Pickering "A" produced
6 electricity at 71 per cent of the cost of
7 an equivalent amount of energy from
8 Lambton.

9 Now, I would take it that that kind of an
10 explanation for why the life expectancy at Douglas
11 Point is not relevant wouldn't be an explanation you
12 would repeat today given the evidence we heard this
13 morning about the Pickering payback agreement; is that
14 fair?

15 A. I'm sorry, I don't see a connection
16 between the two at all.

17 The Depreciation Review Committee at
18 Hydro has the conferred responsibility of our
19 vice-presidents to review the service life of all
20 components, not just in nuclear stations but in fossil
21 and hydroelectric and other transmission systems, and
22 it does it based upon its engineering judgment, its
23 experience and operating Hydro facilities, Hydro-owned
24 facilities, and it has no relationship, as far as I am
25 concerned, to the payback agreement with the provincial

1 and federal governments or with Douglas Point.

2 Q. Right. So my question was, that the
3 explanation given on page 47 is not an explanation you
4 would repeat?

5 A. Well, I don't see anything
6 particularly wrong with the explanation on page 47.
7 But the lifetime of our nuclear generating stations -
8 and since I have been on the Depreciation Review
9 Committee for many years, I had something to do with
10 it - is related to the experience in operating our
11 plant which by 1983 we had considerable experience, at
12 least we had more than 10 years experience, and it is
13 related to what are the critical components, what is
14 their life, that would cause a diseconomy of extending
15 the life. That's the basis of it.

16 MS. McCLENAGHAN: Mr. Chairman, I would
17 like to turn now to the Materials Dealing with the Cost
18 of Nuclear Power, Fourth Report, June 7, 1990, and
19 Materials on Nuclear Economic Viability. We should
20 obtain exhibit numbers for both of those.

21 THE CHAIRMAN: First one, please.

22 THE REGISTRAR: 618.

23 THE CHAIRMAN: That will be the Cost of
24 Nuclear Power, Fourth Report.

25 THE REGISTRAR: Yes.

1 THE CHAIRMAN: And the next exhibit will
2 be?

3 THE REGISTRAR: 619.

4 THE CHAIRMAN: And it will be the
5 Materials on Nuclear Economic Viability.

6 THE REGISTRAR: Yes.

7 ---EXHIBIT NO. 618: Document: Cost of Nuclear Power,
8 Fourth Report, June 7, 1990.

9 ---EXHIBIT NO. 619: Materials on Nuclear Economic
10 Viability.

11 MR. McCLENAGHAN: Q. Now, again, Mr.
12 Penn and Mr. Daly, you have said that you are both
13 familiar with the U.K. Electricity system or in the
14 U.K. the Central Electricity Generating Board; is that
15 right?

16 MR. PENN: A. I have an appreciation of
17 the situation. I wouldn't say I was overly familiar,
18 but I have an appreciation.

19 Q. And Mr. Daly?

20 MR. DALY: A. I left England in 1969 and
21 so my contacts have been somewhat limited. I am
22 probably in the same situation as Mr. Penn.

23 Q. Would it be fair to say that before
24 1989, that the U.K. Central Electricity Generating
25 Board and Ontario Hydro had some factors in common, for
example, both of them were central state-owned

1 monopolies; is that right?

2 MR. PENN: A. Correct.

3 Q. And both of them were mainly
4 wholesalers of power?

5 A. Correct.

6 Q. And both of them had an integrated
7 grid?

8 A. Yes.

9 Q. And both of them were largely coal
10 and nuclear based with more nuclear expansion planned?

11 A. I think there is a difference there.
12 Ontario Hydro, of course, has significant hydroelectric
13 power that the British Isles doesn't have.

14 Q. And prior to 1989 the U.K. had more
15 nuclear expansion planned?

16 A. I can't remember the actual capacity
17 of nuclear plant in Britain, but I fully expect it
18 would be larger than Ontario.

19 Q. Would you agree that both of them
20 played an important role in economic development in
21 their local economies?

22 A. They certainly had an influence on
23 the economy, yes.

24 Q. And would you agree that they both
25 had similar regulatory structures in that both operated

1 in a parliamentary democracy through a Minister of
2 Energy and were subject to parliamentary scrutiny and
3 Royal Commissions and nuclear regulation by similar
4 bodies?

5 A. Yes.

6 Q. And would you agree that great
7 expertise in nuclear energy systems and operations
8 developed in the U.K. much of which later benefited
9 Ontario Hydro as people like yourselves, U.K.-trained
10 nuclear specialists were recruited to Canada?

11 A. As you know, Canada is rich in
12 heritage, there are people from all over the world that
13 have contributed.

14 Q. But is it fair to say that much of
15 the expertise developed in the U.K. did benefit the
16 Ontario Hydro nuclear system?

17 A. It certainly played a part, yes.

18 Q. Now, I understand that for many years
19 the nuclear system in the United Kingdom was widely
20 perceived to be economic, not only within the CEGB, but
21 in government and industry. Did you share that
22 perception at the time?

23 A. I don't think I am in a position to
24 really advise on that subject, because, as I mentioned,
25 I was one of the early starting people in Britain in

1 1955 but I left in 1962. My work was entirely
2 technical during that time.

3 Q. Mr. Daly, are you in a position to --

4 MR. DALY: A. I think I am in basically
5 a similar position. I was involved in the early years
6 of nuclear power development there and my primary
7 interest was technical. I really don't have any
8 economic knowledge dating from that period.

9 Q. Did you have the opinion that the
10 nuclear system in the U.K. was uneconomic?

11 A. No. Certainly not at that time, no.

12 Q. Now, as I understand it, in 1989 and
13 today there is a different system and I am wondering if
14 you are familiar with the U.K. situation and the
15 partial privatization of the energy system?

16 MR. PENN: A. Yes, I am.

17 Q. Are you familiar with the fact that
18 many people's assessment of the economics of the
19 nuclear industry changed when privatization was being
20 examined and the nuclear industry's books were open to
21 the scrutiny of the public and industry?

22 A. Well, there are many reasons for the
23 change. The very fact of considering privatization in
24 itself caused dramatic change, for the worst, I would
25 suggest.

1 Q. Meaning that the perception became
2 that nuclear energy was not economic, whereas
3 previously it had been perceived to be economic?

4 A. Well, of course I can only give a
5 personal opinion on this, but having studied this
6 document -- and of course this document is just one of
7 mountain of documents, what I was referring to, Ms.
8 McClenaghan, was that the depreciated life, for
9 example, significantly changed from 40 years to 20
10 years. And the reason for that is fundamental, that
11 when you have a private company who invests money for a
12 return, then it needs an assured market, and it wasn't
13 possible, as far as I can understand the circumstance,
14 to guarantee a market to a private company for that
15 length of time, whereas when CEGB had a monopoly, and
16 actually operated the same as Hydro at power at cost,
17 then the issue of a market didn't arise. That was very
18 fundamental.

19 Q. Now, if Ontario Hydro operated under
20 the U.K.'s type of structure, do you think the
21 viability of Ontario Hydro's nuclear plants might be
22 perceived to be different than it is now?

23 A. Well, I don't think I am in a
24 position to comment on that. This is a subject that
25 you would have to go into a great deal of study.

1 I would comment that the circumstances in
2 Britain are so completely different from here, that to
3 draw a parallel of the circumstances there and say,
4 well, might it or could it or will it happen here is
5 just not possible.

6 Just to indicate what I am mean, Mr.
7 Chairman, whereas here in Ontario we have
8 single-mindedly concentrated on one nuclear system, the
9 CANDU nuclear power system, in Britain there have been
10 four systems, and not only have there been four systems
11 but, for example, the Magnox reactors and the advanced
12 gas cooled reactors were designed and built by as many
13 as five different companies. So there was no
14 standardization. And the performance of some of these
15 plants has been poor, very poor.

16 And so when you move towards
17 privatization, as the British government decided, then
18 the liabilities of these in the private sector causes
19 all sorts of arrangements to be made, not the least of
20 which is the question of reprocessing.

21 So the whole comparison of the two
22 jurisdictions just cannot be made. There is no level
23 playing field.

24 Q. Just to clarify one earlier point,
25 Mr. Penn, I think you indicated a minute ago that they

1 sold power at cost, CEGB, and I am wondering if it
2 might not be the case that they did earn a rate of
3 return?

4 A. Are you asking with whether CEGB
5 earned a rate of return?

6 Q. Right. As opposed to merely selling
7 power at cost.

8 A. I don't know if Mr. Daly can help me,
9 but to my knowledge they operated in - at least when I
10 was there - in the same sense that Hydro does today.

11 Just like ourselves, they had regional
12 distribution offices like we have, the Municipal
13 Electric Association and all the public utilities, they
14 had that, and they had central dispatching. As you
15 said earlier, CEGB sold bulk power to these
16 municipalities or public utilities.

17 I don't know enough about the financing
18 of the British situation and whether, in fact, years
19 ago they looked to generate funds or a profit, if you
20 will, for future investment. That certainly is the
21 case now, of course.

22 Q. Now, I take it from the comment you
23 made a moment ago about the differences, that you might
24 agree that the viability of nuclear power depends on
25 the kind of system it belongs to. Would that be a fair

1 statement?

2 A. I don't think so. The viability of
3 nuclear power depends upon very many characteristics,
4 such as I like to feel is exemplified by Ontario Hydro.
5 It requires infrastructure, the characteristics I have
6 talked about in my opening direct evidence, it needs
7 infrastructure, it needs the right resources, it needs
8 the support from industry, it needs dedication, it
9 needs single-mindedness, it needs standardization, such
10 as the French have done, for example.

11 [3:12 p.m.]

12 MR. DALY: A. I would also add that it
13 is also feasible in smaller utilities like New
14 Brunswick Power, the Point Lepreau station, there is
15 one station there operating well as a fairly high
16 percentage of the province's electrical supply. So it
17 is feasible in some situations on a smaller basis.

18 Q. Now a few moments ago, Mr. Penn, you
19 commented that there was difficulty with respect to
20 privatization of the nuclear power plants, and you
21 mentioned the differences in the expectations of the
22 private sector in terms of guaranteed markets over a
23 time span, and so on.

24 Do you agree that it would be difficult,
25 if not impossible, to privatize nuclear reactors in

1 Ontario because of the private sector's perception of
2 the financial risks involved?

3 MR. B. CAMPBELL: Well, could I just -- I
4 don't know, Mr. Chairman, Mr. Penn has been careful to
5 qualify that in various areas he is giving his personal
6 view and that has, I'm sure, been noted, but when it
7 comes to evaluating risks as perceived by financial
8 markets, I wouldn't have thought that these witnesses
9 are qualified to give opinion evidence in any respect
10 on that topic. To the best of my knowledge, none of
11 these witnesses are financial market analysts or
12 analysts of risks as perceived by financial markets,
13 and I think we are stretching opinion evidence rules
14 way beyond, in my submission, where they should be
15 stretched.

16 MS. McCLENAGHAN: Well, maybe I can ask
17 this question.

18 Q. Is this an issue which you have
19 thought about or considered, Mr. Penn, or Mr. Daly, or
20 anyone else on the panel, as to whether or not it would
21 be difficult or possible to privatize nuclear reactors
22 in Ontario?

23 MR. B. CAMPBELL: Mr. Chairman, --

24 THE CHAIRMAN: She simply asked him
25 whether they have thought about it and I suppose they

1 can answer that question.

2 MR. PENN: I haven't given it a single
3 thought.

4 MS. McCLENAGHAN: Q. And is that the
5 case with everyone else on the panel?

6 MR. DALY: A. My only thinking in the
7 matter has been well, perhaps, 5, 10 years from now we
8 might get a clear idea whether what has been done in
9 Britain has been for better or for worse, but it's
10 probably going to take that length of time at least
11 until it's clear.

12 Q. Now, as well, in the Energy Committee
13 report there's a discussion, and you alluded to it, Mr.
14 Penn, about the 40-year depreciation period and the
15 Energy Committee characterized it at paragraphs 111 and
16 112 as unrealistic and implausible.

17 THE CHAIRMAN: Are you referring us now
18 to a page in the material?

19 MS. McCLENAGHAN: It's page 34 and 35 of
20 Exhibit 618.

21 MR. PENN: I'm sorry. Were you asking me
22 a question?

23 MS. McCLENAGHAN: Q. I hadn't asked the
24 question yet.

25 MR. PENN: A. Thank you.

1 Q. The question is, do you think that a
2 40-year depreciation period is implausible or
3 unrealistic for nuclear reactors?

4 A. Well, we practice the 40 year
5 depreciation in Ontario Hydro for our nuclear plant and
6 our fossil plant. We practice a 100-year depreciation
7 for a hydroelectric plant and I think under the
8 circumstances that we in Ontario see, it is quite
9 realistic.

10 Q. All right. And what's different
11 about the circumstances in Ontario than in the U.K.
12 that makes it realistic do you think?

13 A. Well, first of all, in case I didn't
14 say it, this situation in Britain is extremely complex.
15 As I noted earlier, the hearing itself went on for
16 two-and-a-half years. There were some extremely
17 eminent people in Britain who gave evidence, including
18 Lord Marshall, the Chairman of the CEGB at that time.

19 You have to realize the circumstances
20 that existed there, you can't pick out just one subject
21 like should we have a 40-year depreciation or a 30-year
22 or a 20-year? There were lots of other issues that
23 went with it that related to the risk to the private
24 sector, and the risk of retaining a guaranteed market,
25 and the accrued liabilities over many years previous to

1 that. So there were a whole set of reasons for which
2 I'm sure if you have read the report in detail that you
3 would understand.

4 This is a personal view again and my
5 counsel may not want me to make a personal view, but --

6 MR. B. CAMPBELL: It hasn't stopped you
7 so far, Mr. Penn.

8 MR. PENN: It's rare in private business,
9 and I have been employed in private business where
10 companies wish to take risks and seek return over
11 extremely long periods. That is not what they are in
12 business for, but depreciation over long periods by a
13 group such as state controlled utilities, that's a
14 different situation. It's serving the people for the
15 long-term. They are not serving themselves. They are
16 serving the people.

17 MS. McCLENAGHAN: Q. All right. In that
18 respect, if the nuclear power plants were being
19 operated in a regime, for example, closer to the U.S.
20 type of structure with more competition and independent
21 generators having more access to the grid, do you think
22 the viability of Ontario Hydro's nuclear plants might
23 be perceived to be different?

24 MR. PENN: A. Well, I think as a
25 planning issue perhaps Panel 10 will have more views

1 than I do. I really don't know the circumstances of
2 different American utilities and the regulatory process
3 of setting rates in the United States well enough to be
4 able to comment on the relationship between non-utility
5 generators and utilities that own nuclear power plants.

6 Q. Now according to the Energy Committee
7 report at page 22 of the exhibit package and,
8 particularly in paragraph 55, the Electricity Bill had
9 included provisions which the government believed could
10 provide the basis for contracts for the sale of power
11 from existing and new nuclear power stations, and so
12 on, and it says that provisions were, and the last
13 point was:

14 "Power for the government to give
15 financial assistance of up to 2,500
16 million pounds subject to parliamentary
17 scrutiny in respect of unforeseen
18 increases in the cost of reprocessing
19 waste management and disposal and
20 decommissioning."

21 And it appeared that, according to page 26 of the
22 report in paragraph 75, National Power suggested a
23 provision of 10 billion pounds of nuclear provisions is
24 what would have been required.

25 Do you have any estimate of the amount

1 that the private sector in Ontario would require to
2 assume nuclear ownership with its unanticipated risks,
3 such as waste management and disposal, reprocessing and
4 decommissioning?

5 A. Well, I think it is a theoretical
6 question. Ontario Hydro, and I, in my direct evidence,
7 indicated what provisions we are making for used fuel,
8 for decommissioning and for low level and intermediate
9 level waste. And we have done that on the basis of the
10 resource system we expect to have, and the knowledge we
11 have, and I can't speculate on what the private
12 industry, whoever they might be, would have.

13 Q. Now, as you know, the U.K. government
14 realized in November 1989 that its nuclear plants could
15 not be privatized and instead placed them in a
16 Crown-owned nuclear utility called Nuclear Electric.
17 Are you familiar with that?

18 A. I am familiar with Nuclear Electric
19 company, yes.

20 Q. I understand that power from the
21 nuclear plants cannot yet compete with power from the
22 non-nuclear plants. Although there's an improvement,
23 the nuclear plants have performed well, and in the
24 first full year of the company's operation it achieved
25 the highest ever output from its 24 operating reactors,

1 and there is a report to that effect in Exhibit 619 in
2 the Independent, September 8th, 1991.

3 I'm sorry. I have given you the wrong
4 reference. It's page 4 of Exhibit 619. And there's a
5 news article in the middle of the paragraph indicating
6 that Mr. Collier, the Chairman of state-owned Nuclear
7 Electric, in the middle of the paragraph it says:

8 Mr. Collier said last week, I believe
9 the government if we do certain things
10 might look at us for privatization again
11 in 1994 on the basis that their
12 performance was so much better than
13 it had been before.

14 Are you familiar with that?

15 A. I remember reading this but I'm
16 sorry, I'm on page 4, and where should I look again
17 please? In the middle?

18 Q. In the middle of the paragraph it
19 begins, "...but Mr. Collier said last week..."

20 A. Oh, this is at the top part?

21 Q. Yes. I'm sorry. The first news
22 article.

23 A. Well, I imagine why Mr. Collier said
24 that, and I was recently in Britain talking with
25 Collier and John Board at Nuclear Electric in

1 Knutsford, and they are striving very hard because in
2 1994 there is a government inquiry into the future of
3 nuclear power in Britain, and there is expected to be
4 extensive hearings and testimony, and I am sure that he
5 made those comments in light of that circumstance.

6 Q. Do you think it's possible that the
7 nuclear plants in Ontario might be better producers if
8 they too operated in a more competitive environment?

9 MR. B. CAMPBELL: Mr. Chairman, you
10 know --

11 THE CHAIRMAN: Well, if he does not know
12 the answer, he can say he doesn't know.

13 MR. B. CAMPBELL: That may be, Mr.
14 Chairman, but -- well, I'll --

15 THE CHAIRMAN: He says he hasn't thought
16 about it so I don't know if there's not much foundation
17 for the answer.

18 MR. PENN: All I can say, Mr. Chairman,
19 is if you have read a few newspapers about Ontario
20 Hydro recently, there is an extremely competitive
21 environment in the corporation. We are cutting our
22 costs; the chairman has given papers on this; we are
23 cutting our salaries, so, yes, --

24 THE CHAIRMAN: All right.

25 MS. McCLENAGHAN: Q. Are you aware, Mr.

1 Penn, that in the United Kingdom the non-nuclear fuels
2 must pay a levy to subsidize the nuclear system?

3 MR. PENN: A. Yes I am.

4 Q. And that it amounts to 1.3 billion
5 pounds?

6 A. Well, I can't confirm that number but
7 this is one of the very many complex circumstances that
8 came out of the long debate of privatizing British
9 industry and particularly the electric industry, and
10 clearly with such a large liability on their nuclear
11 program, and because it's capacity factors have been
12 very low, private industry without enormous assurances
13 from the government of Britain were not interested in
14 purchasing those resources.

15 So one of the things that the government
16 in Britain decided in the end to do, and this was their
17 choice, I don't know the wisdom of it, was that they
18 said, We will raise a levy on fossil fuel in order to
19 write off the cost of nuclear power in Britain over a
20 shorter length of time.

21 I imagine Mrs. Thatcher had in mind that
22 eventually she would privatize if she remained Prime
23 Minister there. And maybe John Major will do the same
24 thing, I don't know. But that was the intent of the
25 process.

1 Q. Is it your understanding that
2 according to the Energy Committee report nuclear
3 power's cost was two-and-a-half times the cost of coal
4 or gas and that's found at page 12, paragraph number
5 10?

6 A. Well, there's a lot of cost
7 comparisons in that paragraph. Could you point me to
8 where you were reading?

9 Q. It indicates that coal-fired
10 generation in the fourth line the cost is 2.5 to 2.6
11 pence per kilowatthour.

12 A. Yes, I have that number.

13 Q. And then it indicates a couple of
14 sentences later, four lines more, that National Power
15 put the lifetime private sector price of PWR generation
16 calculated on a different basis at 6.25 pence per
17 kilowatthour.

18 A. Yes, it did. But you have to
19 understand that of course this document is a summary of
20 a very long hearing, and what they are referring to
21 there is that National Power -- the original idea of
22 the British government was that they would form two
23 companies in Britain plus a distribution company and
24 hopefully a nuclear company.

25 [3:30 p.m.]

1 National Power originally suggested to
2 them that they would have a significant amount of the
3 fossil resources of Britain plus nuclear. And the
4 other company, which is called Power Gen would have the
5 remaining fossil.

6 And it was at this point that National
7 Power, in their discussions with the government,
8 indicated that since they were now operating as a
9 private company, and they were concerned about their
10 future liabilities and their profitability, they
11 included a reduction in the depreciated life of the
12 plant from 40 years to 20 years, and they also
13 introduced the concept of internal return on revenue,
14 or if you like, profit for the use of future investment
15 in equipment.

16 And in the meantime as well, there were
17 significant increases in costs at the British Nuclear
18 Fuels Limited Company who of course reprocessed the
19 fuel in Britain and provide a fuel production service
20 that was also part of this cost.

21 So, there are many issues here that, you
22 cannot compare -- and the previous numbers you read out
23 were based upon CEGB's projected costs as a national
24 power company, as Hydro is, a monopolistic company.

25 So those are the only comments I can make

1 about this.

2 I am not for one moment defending the
3 British nuclear program. I am just trying to explain
4 the circumstances.

5 Q. I would like to refer you to page 17
6 of the report, and particularly to paragraph 31. They
7 say:

8 We do not accept Lord Marshall's case
9 that the private sector price should
10 assume a lower level of availability than
11 the public sector price and that the
12 private sector price but not the public
13 sector price should incorporate an
14 allowance for fuel reprocessing and
15 decommissioning uncertainties. Lord
16 Marshall states that in the private
17 sector, "We had best be more prudent at
18 guessing the availability of the plant as
19 we are certain to make a loss."

20 And then the paragraph goes on a couple
21 lines later to say:

22 We agree that as Lord Marshall
23 explains, downside risk is punished very
24 severely in the marketplace, but we do
25 not believe sufficient account was taken

1 of the same risks when seeking to justify
2 Hinkley Point "C" as a public sector
3 project. We regard the idea that the
4 public sector need not be as prudent as
5 the private sector as an incitement to
6 appraisal optimism and reject the belief
7 of the CEBG and the department that
8 different assumptions as to availability
9 and other uncertainties should be made
10 according to whether a project is in the
11 private or in the public sector.

12 What is your opinion regarding the
13 appropriate level of public versus private sector risk
14 when dealing with nuclear plants?

15 A. Well, I don't think I have any. All
16 I can say is that Ontario Hydro, being responsible for
17 this province's nuclear program, has pulled together
18 resources to safely and reliably and economically
19 manage it, with due regard to the environment and
20 health of people, and that's why the five of us are
21 here.

22 I would just suggest to you that if the
23 same assets were in the hands of private enterprise,
24 then they would have to do the exactly the same thing.

25 Q. Now, the next paragraph of the

1 report, paragraph 32, states that:

2 We accept, as did Mr. McCairn that
3 some costs differ between the public and
4 private sectors. The period of
5 depreciation may differ and some elements
6 of risk are greater in the private
7 sector. Although principally because of
8 the move from a situation in which the
9 CEGB could be sure of passing on costs to
10 one in which National Power has to come
11 compete for custom rather than because of
12 privatization as such.

13 Then it goes on to say:

14 However, we reject the view of the
15 CEGB National Power and the department
16 that the cost of electricity from a
17 reactor could be almost doubled by
18 privatization and we are profoundly
19 concerned that the CEGB should have put
20 forward a low figure to a public inquiry
21 in support of the case for a major public
22 investment and one almost twice as high
23 shortly afterwards for power from the
24 same reactor in the private sector.

25 My question is: In the case of Ontario

1 Hydro's reactors, would your estimates of the price of
2 power from your existing reactors be the same or
3 different if the reactors were in private hands?

4 A. I just don't know. I don't know.

5 THE CHAIRMAN: Could we take a break
6 before we start with the next part of it?

7 MS. McCLENAGHAN: Sure, we can do that.
8 Thank you.

9 THE REGISTRAR: Please come to order.
10 This hearing will break for 15 minutes.

11 ---Recess at 3:40 p.m.

12 ---On resuming at the 4:00 p.m.

13 THE REGISTRAR: Please come to order.
14 This hearing is again in session. Please be seated.

15 MS. McCLENAGHAN: Q. Mr. Daly, I wonder
16 if I can turn you to Exhibit 611, which is at tab B, of
17 the materials, and in particular to page 2 of that
18 exhibit, which contains an excerpt from previous
19 testimony that you gave in Volume 121.

20 MR. DALY: A. Right.

21 Q. And on page 21183, at lines 9 to 14,
22 you indicated that in addition to the 10 Canadian
23 units, other countries well represented in the top 36
24 are Germany with the six units, United States with five
25 units, Belgium with four units, Japan with three units

1 and Spain with three units.

2 I am wondering if you know whether
3 Germany, the United States, Spain or Belgium have
4 placed reactor orders lately?

5 A. I am not aware of any in the United
6 States. Perhaps Mr. Penn is in a better position to
7 answer this one than I am.

8 MR. PENN: A. Certainly the United
9 States hasn't placed an order since 1978.

10 Germany were developing the Convoy series
11 of pressurized water reactors, and I would be guessing
12 but there was several built and I guess the last one
13 might have been ordered in the early 80s. And Belgium,
14 to my knowledge, although it has one of the cheapest
15 nuclear systems in the world, I don't think has ordered
16 one since the joint ownership with EDF, I think it is
17 called Chooz 2 or 3, since about the early 80s.

18 Did you mention Japan?

19 Q. Spain I mentioned.

20 THE CHAIRMAN: And Japan.

21 MS. MCCLENAGHAN: Q. And Japan, yes.

22 MR. PENN: A. Japan, of course, as I
23 gave in direct testimony, has just ordered two
24 evolutionary advanced boiling water reactors last
25 December, at least when construction started, and is

1 about to order another two later this year.

2 Spain I don't think has ordered a new
3 unit in the last 10 years.

4 Q. So just to confirm our understanding,
5 in Belgium that there are no reactors under
6 construction and no new reactors that you know of; is
7 that right?

8 A. Well, no, because France has --

9 THE CHAIRMAN: She is talking about
10 Belgium, I think. Is that right?

11 MS. McCLENAGHAN: Yes, Belgium.

12 MR. PENN: The reason that Belgium hasn't
13 ordered is because they purchase nuclear electricity
14 from France in significant quantities.

15 MS. McCLENAGHAN: Q. And with respect to
16 Germany, my understanding is that post reunification
17 all of the East German reactors closed and one West
18 German reactor closed, and a moratorium may be placed
19 on new construction; is that your understanding?

20 MR. PENN: A. Well, all I can state is
21 what I read in the papers about the former East
22 Germany. I believe you are right. I don't know
23 whether they closed all of them.

24 I am not aware of one being closed in
25 West Germany.

1 And while there has been considerable
2 discussion of a moratorium in Germany, certainly no
3 decision has been made.

4 Q. In Spain I understand that there has
5 been a moratorium on nuclear expansion in place since
6 1983 and that it was reconfirmed late last year; is
7 that right?

8 A. I don't know.

9 Q. I wonder if I could refer you in
10 Exhibit 608 to page 109, and that's an excerpt from
11 Nucleonics Week.

12 A. Sorry, was that 608, Exhibit 608?

13 Q. Yes, that's right.

14 THE CHAIRMAN: Which one is 608?

15 MS. McCLENAGHAN: Exhibit 608 is at tab

16 A. We will be referring to tab A and B in the next
17 little while, Mr. Chairman.

18 MR. B. CAMPBELL: I am sorry, what are
19 tab A and B?

20 THE CHAIRMAN: 608 is tab A and 609 is
21 tab B.

22 MS. McCLENAGHAN: 611, I think, is tab B.

23 THE CHAIRMAN: I have 609 at tab B and
24 611 at tab C.

25 MR. B. CAMPBELL: It was a better

1 question than I thought. [Laughter]

2 MS. McCLENAGHAN: Then we will be
3 referring to tab C and A, Mr. Chairman.

4 MR. DALY: I should point out that the
5 witnesses don't have tabs.

6 Ms. McCLENAGHAN: No, neither do I.

7 THE CHAIRMAN: Neither does Ms.
8 McClenaghan, that's the trouble.

9 MS. McCLENAGHAN: Q. It's Exhibit 608,
10 page 109. That's an excerpt from Nucleonics Week, Mr.
11 Penn, and I think you had told me earlier that that is
12 a respected nuclear industry trade journal. There is a
13 report under the title: Japanese Utilities Building
14 Plans Face New Obstacles, Moodies, says, and it's dated
15 May 9th, 1991. The first paragraph indicates that:

16 Growing anti-nuclear sentiment may
17 frustrate Japanese utility plans to
18 offset thin and shrinking reserve margins
19 by building new nuclear units, a New York
20 based investment service company says.

21 And then on page 110 the article
22 continues under the bold type:

23 In fact, no new nuclear reactor sites
24 have gained approval since 1986. Some
25 projects are already in doubt because

1 sites required for the 1990s expansion
2 have not been secured yet.

3 Are you familiar with that situation in
4 Japan?

5 MR. PENN: A. I am familiar with the
6 Japanese, situation, yes.

7 Q. Is that consistent with your
8 understanding of the situation in Japan?

9 A. Well, the first paragraph you read to
10 me, and I guess the author Anne McLaughlin of Paris is
11 expressing an opinion that growing anti-nuclear
12 sentiment may frustrate. All I can say about that
13 situation is that the Japanese government has had for
14 the last two or three years an extensive information
15 program in Japan, whether that is making any difference
16 to the circumstance I don't know.

17 The second point you made refers to new
18 reactor sites as opposed to existing reactor sites.
19 There are in Honshu Island and Sapporo in Northern
20 Ireland a considerable number of existing nuclear sites
21 that have considerable land in order to build more
22 plants, and that's where ones that are being ordered
23 now will go.

24 And more recently the electric power
25 development corporation, which is owned 80 per cent by

1 the government and 20 per cent by private enterprise
2 has secured a new site in Northern Honshu Island to
3 build a heavy water slightly enriched reactor of about
4 600 megawatts.

5 Q. Now, when you were mentioning a
6 moment ago about the sites where reactors will go, is
7 it your evidence that those sites have been secured?

8 A. You mean the ones that I just
9 mentioned in Northern Honshu Island?

10 Q. No, the one before that. You were
11 mentioning some sites where other reactors will go.

12 A. Well, they are building them and I
13 personally visited those sites.

14 Q. These are sites required for the
15 1990s expansion?

16 A. Yes.

17 Q. So it would seem that this report was
18 in error in that respect then, is that your
19 understanding.

20 A. When it was written, and I have
21 forgotten the date on it --

22 Q. May 1991.

23 A. Last spring, a year ago, it was true
24 that no nuclear reactor sites have gained approval
25 since 1986. But as I just mentioned, the Electric

1 Power Development Corporation has just sought approval
2 and negotiated with the Fisherman Union in the area
3 which was the key concern, and I understand agreement
4 has been reached.

5 Q. I would like to refer you to Exhibit
6 611, and particularly to page 3, which contains an
7 excerpt of your direct evidence from Volume 122.

8 You noted at line 6 to 11 of that page
9 that France, Finland, U.S., Korea, Japan and the United
10 States -- the U.K., Korea, Japan and the United States
11 have plans to build or are building new evolutionary
12 light water reactor designs; is that right?

13 A. Yes.

14 Q. Do I understand you to mean that they
15 are working on new designs or that they presently have
16 these reactors on order or under construction?

17 A. Well, a bit of both.

18 France, as we testified earlier, has a
19 committed to build and is starting on five plants for
20 in-service around about 1999 to 2002, I believe it is.
21 And in addition France is planning what is known as REP
22 2000, which is a new evolutionary French pressurized
23 water reactor, in conjunction with Germany, through a
24 company that they joint countries have formed called
25 NPI, which is mainly owned by Framatome and Siemens.

1 [4:12 p.m.]

2 Did you want me to go through them all?

3 Q. Well, actually, I was wondering if
4 you could tell me what the status of the nuclear
5 programs was in Finland?

6 A. Well, I'm not as familiar with
7 Finland, but I did meet with Thor Petersen of Sweden,
8 ASEA Brown Boveri, I guess towards the end of January
9 in Paris, and discussed with him the ABBBW90 and the
10 PIUS design that we touched on earlier the day before
11 yesterday, and he informed me that his company has
12 tendered to the Finnish utility - whose name is I
13 forget, I'm sorry, I forgot the name - and we were also
14 informed when we visited with General Electric in the
15 U.S. that they are tendering; they had been invited,
16 and we also believe that NPI in Paris and at least at
17 one time the Russians were tendering. Whether that's
18 continued with I don't know. And I believe that the
19 Finnish government is presently considering the matter.

20 Q. Right, and hasn't decided yet on
21 those proposals or on whether to build?

22 A. No, I agree with you, it hasn't been
23 decided but it would be a fifth nuclear power station
24 in Finland.

25 So my words in this sentence was that

1 they have plans to build and I think that if someone
2 saw tenders from companies, they have plans.

3 Q. Is it your understanding that those
4 tenders went in in 1986?

5 A. I don't know when they went in. I
6 assumed from my conversations that they were recently
7 tendered.

8 Q. Is it your understanding that just
9 within the last week or so that the Finland government
10 again decided to postpone the decision until a more
11 politically suitable time?

12 A. I don't have that knowledge.

13 Q. I would like to refer you to page 22
14 of Exhibit 611. And the question was, was put to you:

15 Worldwide Nuclear Energy is playing an
16 increasingly vital role in meeting the
17 demand for electricity.

18 You indicated:

19 It is certainly playing an increasing
20 role, yes.

21 Is that your understanding?

22 A. That's my understanding, that the
23 amount of electricity generated by nuclear power is
24 slowly increasing.

25 Q. I would like to refer you to page 23

1 of the material, which is a graph prepared and
2 published by the International Atomic Energy Agency,
3 March 1991, and it shows a graph of the nuclear
4 electricity generation and share of total electrical
5 energy in the 1980s. It would appear from this graph
6 that for the last two years represented in the graph
7 that nuclear electricity's share of the total electric
8 generation declined. Is that something that you would
9 disagree with?

10 A. Well, that's what the graph shows,
11 although the decline is very modest.

12 Q. But it's not increasing?

13 A. Mr. King has pointed out to me that
14 the total energy delivered to the grid in terawatthours
15 is significantly higher in 1990 than 1985.

16 Q. But as a percentage of total it
17 appears that it's decreased for those years; is that
18 right?

19 A. Well, I guess that means that other
20 energy sources have met the increasing world demand.

21 I don't know from this sheet of paper
22 whether IAEA are just including OECD countries, or
23 whether it is totally throughout the world. We know
24 that in China, for example, there's been significant
25 fossil generation built in recent times.

1 Q. I would like to refer you to page 24
2 of the exhibit package. And this, again, is a chart
3 prepared by the IAEA and it's dated, as well, March
4 1991, and they are predicting that the future
5 proportion of nuclear power's contribution to total
6 electrical capacity will decline from the present
7 share, it appears from 11.7 per cent in 1990 to 9.3 per
8 cent, a range of 9.3 per cent to 10 per cent in the
9 year 2010 depending on whether it's a low or high gross
10 scenario. Is that what that chart appears to
11 represent?

12 A. That's what the chart says. But I
13 would point out that different organizations in the
14 world, I mentioned OECD; there is NEA in Paris;
15 there's EPRI; there's USCA, many others that try to
16 predict the future and, I think, 2010 is the future,
17 and there is considerable differences of view on how
18 the world will unfold and this, in my view, is one view
19 and within the error of accuracy, and what happens in
20 changing times, I see these numbers as being very
21 similar.

22 Q. You think these numbers would be
23 about right? Is that what you are saying?

24 A. No. I'm saying that the difference
25 between

1 11.7 per cent today and between 9 and 10 per cent in
2 2010 within the uncertainty of predictions are similar
3 numbers. That's all I'm saying. I am not saying other
4 studies would give similar numbers. I'm sure if you
5 asked AECL, for example, they would probably tell you
6 that it's considerably higher.

7 Q. I take it you are familiar with the
8 International Atomic Energy Agency, and at page 25 of
9 the material from the IAEA Bulletin, March 1991, is a
10 statement of their mandate, and is this consistent with
11 your understanding that their mandate is to accelerate
12 and enlarge the contribution of atomic energy to peace,
13 health and prosperity throughout the world and to
14 ensure so far as it is able that assistance provided by
15 it or at its request or under its supervision or
16 control is not used in such a way as to further any
17 military purpose?

18 A. Yes. I don't know whether that's a
19 complete statement, because the IAEA also have very
20 significant interests in safety, and if Mr. King wants
21 to comment on that? It is not mentioned here, safety,
22 unless it's incorporated within the word "health".

23 Q. All right. So it would be unlikely
24 that the IAEA wouldn't be giving its best estimate in a
25 chart, such as the one we just saw?

1 A. Well, I wasn't doubting that it
2 wasn't doing that. I was just saying that trying to
3 predict energy growth throughout the whole world and
4 what participation nuclear will have in it is, well,
5 you do your best on the basis of information available
6 and, therefore, it's a matter of judgment.

7 My colleague Mr. King is pointing out to
8 me on page 24, it would be very surprising if the
9 world's requirement for electrical energy was not
10 growing in this period of time and, therefore, I think
11 all you can say is that nuclear perhaps is not growing
12 as fast as it was. I mean, it's not that it's
13 decreasing. It's still growing.

14 Q. But it would seem from these
15 predictions that other sources are growing faster; is
16 that fair?

17 A. This prediction would suggest that,
18 yes.

19 Q. I would like to refer you back to
20 Exhibit 597, and I am referring to page 79 of that
21 exhibit.

22 THE CHAIRMAN: The first tab? I'm sorry.
23 79, did you say?

24 MS. McCLENAGHAN: Exhibit 597 is the
25 exhibit titled, Materials Relating to Radioactive

1 Emissions, Health, Environment and Regulation.

2 THE CHAIRMAN: It's page 79 you want us
3 to look at?

4 MS. McCLENAGHAN: Yes, page 79.

5 THE CHAIRMAN: Thank you.

6 MS. McCLENAGHAN: This table as we saw
7 refers to emissions and abatements over an assumed
8 50-year life of Darlington and distinguishes between
9 local and global collective dose savings for various
10 abatement strategies.

11 THE CHAIRMAN: Perhaps you should tell us
12 where this table comes from.

13 MS. McCLENAGHAN: This table was part
14 of...

15 THE CHAIRMAN: It is part of the Atlantic
16 Nuclear Services Report which is Exhibit 601.

17 MS. McCLENAGHAN: Yes. Yes, that's
18 right. Thank you.

19 THE CHAIRMAN: All right.

20 MS. McCLENAGHAN: Q. And, Dr. Whillans,
21 would you agree that global doses are, in addition, to
22 local doses rather than an inclusion of local doses?

23 DR. WHILLANS: A. You mean by the
24 definition that the consultants that prepared this
25 report used? I have no idea what definition -- to me a

1 global dose includes the entire globe.

2 Q. From the indications at the bottom
3 for Noble gases under local and global, would it seem
4 that that was the situation?

5 A. Well, again, I would assume the 10
6 billion population includes the 955,000, but I don't
7 know.

8 Q. All right. But, but under Noble
9 gases under local it indicates collective dose savings
10 in person sieverts of 11.75, and in global it indicates
11 savings of .32 person sieverts?

12 A. That's what it says, yes.

13 Q. So it would seem that the global
14 doses did not include the local doses; is that fair?

15 A. These are the dose savings though, so
16 we are talking about a difference between a global dose
17 or after the savings.

18 Q. The savings from an abatement of the
19 emissions?

20 THE CHAIRMAN: Perhaps someone could tell
21 us what a dose saving is?

22 DR. WHILLANS: Well, it's your table.

23 THE CHAIRMAN: You were using the
24 expression what you think it means and then I --

25 DR. WHILLANS: Okay. I assume that it

1 means that there is a global dose to the global
2 population given in the footnote over 10,000 years
3 which would result if some abatement measure were not
4 introduced. There's another one if it were introduced,
5 and the difference is the savings, but that's just my
6 interpretation.

7 MS. PATTERSON: So dose savings isn't a
8 phrase that you would normally use?

9 DR. WHILLANS: That's the way I would use
10 it, but I am not sure whether the consultants would use
11 it the same way, and I was just pointing out that since
12 we are talking about a difference - I don't know that
13 it's obvious, it's not obvious to me - that the local
14 savings -- the fact that the local savings is greater
15 than the global savings necessarily means that the
16 original global dose did not include the local dose.
17 Maybe that is obvious to everyone else.

18 THE CHAIRMAN: We don't know what it is
19 that it would cause it - from looking at the table
20 alone - what it is that is causing the savings.

21 DR. WHILLANS: That's right, and I don't
22 know the absolute numbers which have been subtracted to
23 give you the savings.

24 MS. McCLENAGHAN: Q. Dr. Whillans, would
25 you agree that for any emissions of elemental tritium

1 from the tritium removal facility, the ratio of local
2 to global emissions would be, or doses would be at
3 least 600 times higher because elemental tritium is
4 roughly 600 times less radioactive than tritiated water
5 but oxidized -- are radiotoxic than tritiated water but
6 oxidizes in a few days into tritiated water?

7 DR. WHILLANS: A. I think you said a
8 number of things I would probably have trouble agreeing
9 with.

10 What do you mean by radiotoxic? Are you,
11 are you giving some index of its relative toxicity on a
12 specific activity basis?

13 Per unit activity I would think that the
14 radiotoxicity of elemental tritium is somewhat more
15 than 600 times less toxic.

16 Q. So you are saying it's more than 600
17 times?

18 A. Well, I can give you the actual
19 number. It depends on what basis we are using the
20 term.

21 Q. Right. So if it's more, it would be
22 at least 600 times higher than the ratio of local to
23 global emissions?

24 A. Well, that's a different question.
25 The ratio of local to global -- this

1 isn't with reference to table 4. The ratio of global
2 to local would depend on the amount of activity that
3 disperses outside the region that we call local, and I
4 don't see anything that helps me with that in this
5 table.

6 Were you asking me independent of the
7 table?

8 Q. Yes. I'm sorry. I am asking you
9 independent of the table.

10 A. I don't think I have that number. We
11 certainly could estimate it, but I don't believe it's
12 included in any of the exhibits that we have provided.

13 THE CHAIRMAN: Wouldn't it be very much a
14 function of what the local area was?

15 DR. WHILLANS: Well, as I said yesterday,
16 that's certainly true because the conversion and,
17 therefore, the amount that is available for further
18 dispersion depends on the site-specific conditions
19 because the conversion occurs largely on the ground, so
20 it would be very different if prevailing winds, for
21 example, blew out over a lake, and so I don't think
22 there is a number, and so I can't provide you a general
23 number.

24 MS. MCCLENAGHAN: Q. Now, you would
25 agree that the elemental tritium oxidizes in a few days

1 into tritiated water; is that fair?

2 DR. WHILLANS: A. The conversion occurs
3 to tritiated water and, again, the time scale would
4 depend on what kind of environment. For instance, it's
5 very different in the winter when the ground may be
6 covered in snow from what it would be in a summer
7 season.

8 Q. All right. So is it fair to say that
9 the global exposed population as opposed to the local
10 population and the environment would receive the doses
11 in the more toxic form, in the oxidized form?

12 A. The conversion will occur depending
13 again on conditions close to the plant, and any
14 activity I would think that is globally dispersed would
15 be something that is taken up into the atmosphere and
16 doesn't contact the ground.

17 [4:30 p.m.]

18 And to the extent that we have agreed
19 that the tritiated water form is much more toxic than
20 elemental tritium, I would say it's the local
21 population that will receive that dose. But ultimately
22 it can be converted to tritiated water at any site. We
23 are just talking about the distribution of it.

24 Q. Is Ontario Hydro actually sure that
25 the tritium removal facility is going to abate global

1 collective population tritium doses?

2 A. From our entire system?

3 Q. Yes.

4 A. Well, to the extent that the tritium
5 removal facility is designed to remove a large fraction
6 of the tritium that's available in all of our stations
7 and to convert that to elemental tritium which is then
8 absorbed into metal as a metal hydride, metal tritide,
9 and this is no longer available for dispersion, I think
10 we have some confidence that that will reduce the
11 global or local population dose.

12 Q. Now, looking at page 79, is it fair
13 to say that the global tritium dose that can be saved
14 by 90 per cent abatement is 5.8 times as large as the
15 local, given the assumptions at the bottom of the page?

16 A. That's what the table says.

17 Q. And the global carbon-14 dose that
18 can be saved by 90 per cent abatement is 675,000 times
19 as large as the local?

20 A. I think so, yes.

21 Q. Would you agree with me that if we
22 looked at the global collective population dose from
23 radon, from radon from uranium tailings, instead of
24 only local effects for 15 years, as you did in Exhibit
25 507, that our assessment of the total impact on humans

1 would increase by an even a greater ratio than this?

2 A. Well, so far we have been talking
3 mainly about geographical dispersion. But I do note
4 that the global population at the bottom is defined as
5 the population of the world for 10,000 years. And we
6 had some conversation yesterday where I indicated that
7 there were major uncertainties in doing those kinds of
8 estimates and that the AECB, for example, and UNSCEAR
9 recommend that much shorter periods be used for the
10 purpose of making decisions about such matters as
11 control of dispersion. It's not to say that we don't
12 take note of what may happen in 10,000 years, but there
13 is just too much uncertainty about the kinds of
14 assumptions that go into the calculation, the health
15 effects, but also the habits, the population
16 distribution and so forth.

17 So, I guess I am saying that I agree with
18 the AECB and UNSCEAR that calculations out to such
19 periods have relatively little use in planning.

20 Q. So the bottom line, though, is that
21 the ratio would be even greater for the global versus
22 local effects from radon; is that right, over 10,000 --

23 A. I don't see radon referred to here at
24 all.

25 Q. Is it your understanding that the

1 radon is produced ultimately from Thorium 230 with a
2 half life of 8,000 years, which is even longer than the
3 carbon-14 which is on this table?

4 A. The usual radon is produced in the
5 uranium decay chain. There are kinds of radon, radon
6 220 and 222. The one we are usually concerned about in
7 tailings is produced from uranium.

8 Q. I would like to refer you to page 77
9 of the exhibit where the Atlantic Nuclear study
10 calculated that a cost of \$1 million to reduce total
11 collective doses to humans by 13,500 person sieverts of
12 carbon-14 would result in a total collective dose
13 reduction of 13,500 person sieverts?

14 A. I see that, yes.

15 Q. And this seems to be about \$74 per
16 person sievert; is that right?

17 THE CHAIRMAN: Is that based on a cost of
18 \$1 million?

19 MS. McCLENAGHAN: That's right.

20 DR. WHILLANS: Seventy-four, yes.

21 MS. McCLENAGHAN: Q. Now, in the
22 interrogatory response which we looked at yesterday on
23 page 73 --

24 DR. WHILLANS: A. Excuse me, may I just
25 add that of course we are talking about dose reduction

1 only of the carbon-14 dose that results from Ontario
2 Hydro's emissions, and as I pointed out, there is a
3 hundred times greater dose to all of us as from
4 carbon-14 as a result of other sources, at least a
5 hundred, yes.

6 DR. CONNELL: Is this still in this
7 10,000 year time scale?

8 MS. McCLENAGHAN: Yes.

9 Q. Now, page 73 of the interrogatory
10 indicated --

11 THE CHAIRMAN: Wait a minute. The answer
12 was affirmative; is that right?

13 MS. McCLENAGHAN: Yes, that's right.
14 Thank you, Mr. Chairman.

15 Q. Page 73 of the interrogatory which
16 accompanied this report indicated at the bottom of the
17 page, after talking about this study having been
18 performed and the cost-effectiveness of reduction of
19 off-site dose, it indicated at the bottom of the page
20 that:

21 The cost associated with reducing the
22 routine emissions are expressed per unit
23 dose averted and for the proposed options
24 studied are typically on the order of a
25 million to \$10 million per person sievert

1 dose averted, and the level at which a
2 dose reduction measure is considered
3 reasonable and beneficial is on the order
4 of \$10,000 - \$100,000 per person sievert
5 averted. And the results from these
6 studies indicate further dose reductions
7 are not warranted.

8 It would seem that that summary in the
9 interrogatory response was not reflective of the \$74
10 per person sievert averted for carbon-14 that we were
11 just looking at in the report itself; is that right?

12 DR. WHILLANS: A. I haven't -- I have
13 just now read the full response.

14 MR. JOHANSEN: A. Ms. McClenaghan, I
15 might just comment further to our discussion yesterday
16 I guess it was, that there are two factors at work here
17 in that cost/benefit analysis.

18 First of all is the cost estimate, and we
19 certainly would have to question the estimate of \$1
20 million, including operating costs, over as long as 50
21 years. And it's not at all clear to us that the 90 per
22 cent reduction suggestion here could be achieved in the
23 way it's suggested.

24 So I don't think we can take the \$74 per
25 person sievert estimate which you derive from this as a

1 given.

2 Q. Is that something that Ontario Hydro
3 has actually studied, that you can say that the numbers
4 reported in the Atlantic Nuclear Report are not
5 correct?

6 A. I can't say for certain that the
7 number is not correct.

8 What I guess I can reiterate is what I
9 noted yesterday, which is that the authors themselves
10 in the full report cautioned the readers about
11 interpretation of both the cost estimates, and I
12 mentioned that they had indicated their confidence
13 within a factor of about two.

14 Now again I have to emphasize that this
15 cost estimate is in the context of a new plant, which
16 as we have discussed yesterday, would be quite
17 different from the backfit or retrofit situation.

18 The more important point, I guess, to
19 note, was their indication that the dose estimates on a
20 local, regional or global basis, and therefore the
21 potential dose savings could be out by as much as 10
22 times.

23 So I am just saying that there are, just
24 on the face of what is presented here, grounds for
25 considerable uncertainty in that number.

1 Now that's not to say that we don't
2 appreciate the issue that we are looking at
3 cost-effective ways of reducing carbon-14 as well as
4 other emissions. I think that's what is alluded to in
5 general terms in the response to the interrogatory.

6 Q. Now, I take it that you would agree
7 with the response in the interrogatory that the level
8 at which a dose reduction measure is considered
9 reasonable and beneficial is on the order of 10,000 to
10 \$100,000 per person sievert dose averted?

11 DR. WHILLANS: A. Well, I should point
12 out, it seems to me that \$74 per person sievert
13 probably is based perhaps on the 10,000 year collective
14 dose. And the numbers that were quoted in here, which
15 are 10 to 100,000 per person sievert, are usually
16 applied to doses in the near future.

17 This number is usually applied to, for
18 instance, a decision on whether to put a dryer into a
19 plant, to reduce an occupational dose that will occur
20 over the next little while.

21 The whole question of what is the
22 appropriate number to apply to doses far in the future
23 I think has not been agreed to anywhere.

24 Furthermore, this is a number which has
25 been used and recommended by groups internationally for

1 perhaps the last 20 years and it is undergoing review
2 at the moment. I am aware of a working group within
3 Ontario Hydro which is reviewing it, new numbers are
4 also being recommended by the USNCR and by the UKNRPV,
5 and in general these numbers are larger because just
6 the value of \$100 in 1970 -- sorry, \$10,000 in 1970 is
7 quite different today.

8 The new numbers also, or the new values
9 are not single numbers. What is recommended in some
10 jurisdictions, for example, in U.K., is a sliding scale
11 where there is a relatively smaller amount recommended
12 for a very small dose, a fraction of background, and a
13 much higher level for, say, 100 millisievert dose in a
14 plant or something like that.

15 So, I guess what I am saying is the
16 numbers that are quoted in this report are what have
17 been traditionally used, but this, as part of the ALARA
18 process, is undergoing review in Hydro and in other
19 parts of the world.

20 DR. CONNELL: Just to follow up, Dr.
21 Whillans, on this time scale 10,000 years, you are
22 speaking of several hundred generations. Do you think
23 it is possible that natural selection might operate in
24 a way such that the biological effects of ionizing
25 radiation might be quite different?

1 DR. WHILLANS: I think many things are
2 possible. It is just very difficult to predict.

3 DR. CONNELL: Do you think it is possible
4 that means of intervention might be discovered related
5 to cause and prevention of cancer or even therapeutic
6 measures that might be different.

7 DR. WHILLANS: I think as I said the
8 previous day, personally I believe that's the case.
9 [4:48 p.m.]

10 It is not a sound assumption to make when
11 emitting hazards which may affect future generations,
12 but I think it is one of the kinds of certainties that
13 you would have to take into account.

14 I guess we shouldn't see some of these
15 procedures as one-sided. That is to say, all we have
16 to do is pay a sum now and avoid a problem. Because
17 with this uncertainty it may be that we are paying the
18 sum to avoid a problem which won't exist, and those are
19 the kinds of things that groups such as ACRP working
20 group are trying to take into account.

21 MR. JOHANSEN: Could I just add as well
22 that our response to Interrogatory 9.6.46 included
23 documentation of our approach to ALARA. I think we
24 have referred to that before but I can't remember for
25 sure.

1 THE REGISTRAR: 9.6.46 is .108.

2 THE CHAIRMAN: Is that a new number?

3 THE REGISTRAR: That's a new number.

4 THE CHAIRMAN: It may turn out it's been
5 in before.

6 ---EXHIBIT NO. 520.108: Interrogatory No. 9.6.46.

7 DR. WHILLANS: You asked a few moments
8 ago about the radon situation. I think it might be
9 good to have perspective about just how this
10 distribution in time occurs, and I don't have the
11 numbers here for carbon-14. It would be different of
12 course because the half lives and the processes by
13 which people are exposed are different.

14 But, for example, UNSCEAR had a very
15 detailed summary of this in the 1982 report. And just
16 to give relative values, these are persons sieverts per
17 gigawatt year of nuclear power generation, and the
18 value for reactor releases is 4, and that's to the
19 local population. The value to the global population
20 over the next 100 years is 12, and the value to the
21 global population from the whole process of the nuclear
22 cycle over 10 to the 8th years, which is the number
23 they use, is 4,000.

24 So, well over 99 percent of these doses
25 will occur far in the future, more than 10,000 years,

1 and even up to the 10,000 year point the value was 800.

2 So, I think it's the case with radon that
3 most of the commitment to infinity is going to occur
4 more than 10,000 years from now, and even if we
5 restrict ourselves to that time frame, most of it will
6 occur, assuming that no simple procedures are taken to
7 prevent it, in the period after 100 years.

8 That's why I'm very reluctant to discuss
9 abatement measures that are going to affect only doses
10 that occur in the far future.

11 MS. McCLENAGHAN: Q. Now. I understand
12 that the time span that you have used is 50 years; is
13 that right -- 15 years, rather, for radon?

14 DR. WHILLANS: A. Sorry, did I say 15
15 years?

16 Is this exhibit 507?

17 Q. Yes.

18 A. Could you refer me to the page?

19 We are looking on page 516 of Exhibit
20 507?

21 Q. And that's found at page 53 of this
22 exhibit.

23 A. Which is this?

24 Q. Page 53 of Exhibit 597 contains the
25 same page.

1 A. That's correct.

2 Now, we are talking in this section about
3 uranium mines and mill sites. And as we discussed
4 earlier this has been included in the chapter on
5 radiological risk or the section on radiological risks
6 for perspective. So I don't think any of us has -- I
7 certainly don't have detailed knowledge of what options
8 are available, for example, to control these risks.

9 But the assumptions that were made for
10 that purpose were that there was a 15-year operational
11 period at the mine and then this was used to estimate
12 how much uranium was mined and processed and fatalities
13 that were associated with it.

14 I don't think it's a 15-year integration
15 period for the exposures.

16 DR. CONNELL: Dr. Whillans, referring
17 back to page 77, Atlantic Nuclear Services Report,
18 could you confirm that the effluent reduction
19 technology that is proposed for carbon-14, I take it
20 that this is simply not relevant to the carbon-14 that
21 is naturally occurring?

22 DR. WHILLANS: No, the carbon-14 that is
23 naturally occurring is produced in the upper atmosphere
24 and comes at us from a different source, different
25 direction.

1 DR. CONNELL: And do you know of any
2 possible means of abatement of that risk?

3 DR. WHILLANS: Well, given that it's
4 intimately mixed with all the other carbon dioxide in
5 the atmosphere, I think it might be difficult. No, I
6 don't.

7 MS. MCCLENAGHAN: Q. Now, in terms of
8 page 53, Dr. Whillans, the statement in the middle of
9 the paragraph indicates, after the reference to IEC
10 Beak 1986, it indicates that the study did not include
11 the long-term impact of abandoned tailings areas but
12 did include the impact from tailings during the
13 operation of facilities.

14 A. Yes.

15 Q. And so you are indicating that you
16 don't believe that those doses were integrated?

17 A. Sorry?

18 Q. You don't believe those doses were
19 integrated only over 15 years?

20 A. The way I read this is that the study
21 which was done by IEC Beak did not include abandoned
22 tailings area but did include the impact from tailings
23 during the operation of the facilities. And then later
24 it says assuming the 15-year operation period given the
25 Beak report.

1 So what I'm saying is that the period, 15
2 years that you referred to, was the assumed operational
3 period to generate a certain number of tailings, right?
4 It doesn't say anything about the integration period
5 for the exposures.

6 I would have to look through this to see
7 what the assumption was about the integration period,
8 but I would assume that it would be something on the
9 order that we have discussed, the 100 years.

10 Q. Now, when you indicated a little
11 while ago that the 10,000 to \$100,000 dollars per
12 person sievert dose averted range is relevant to dose
13 averted in the near future, are you able to say what
14 you consider to be the near future, how many years is
15 that?

16 A. I think what I said is this number
17 has been used in operational health physics, for
18 example, in the context of decisions in an operating
19 plant where doses are received during the operation.

20 It hasn't been applied typically to long
21 range doses or doses far in the future. This has just
22 been the way it has been applied practically.

23 I did say that the subject is under
24 review and some of the things that are being considered
25 or recommended in other jurisdictions are a larger

1 number for the same kind of value, that is one which
2 would be applied in a plant, and a range of values
3 which decreases as the dose averted decreases. In
4 other words, it's not proportional to the dose averted,
5 and there's less emphasis to be given in these
6 recommendations to very, very small doses in the order
7 of fractions of background. But these are all still
8 under consideration and certainly Canada and Ontario
9 Hydro hasn't made a final decision on that number.

10 Q. Now, in terms of the review that you
11 mentioned a couple of times, is that a public review?

12 A. Well, the review I am referring to is
13 one which is being carried out by a working group
14 within Ontario Hydro and it doesn't have a published
15 report. But within the review I know there are
16 references to USNRC recommendations and recommendations
17 from the U.K. I believe, NRPB.

18 But the report itself, the Ontario Hydro
19 report is not published, and then as we talked a day or
20 so ago about the working group of the ACRP, their
21 report has not been finalized either.

22 MS. McCLENAGHAN: Mr. Chairman, I think
23 this might be an appropriate place to stop for the day.

24 THE CHAIRMAN: All right. We will
25 adjourn now till ten o'clock tomorrow morning.

1 THE REGISTRAR: This hearing will adjourn
2 until ten o'clock tomorrow morning.

3 ---Whereupon the hearing was adjourned at 4:59 p.m., to
4 be reconvened on Thursday, April 16, 1992, at
5 10:00 a.m.

25 JAS/JA [c. copyright 1985].



